TROPICAL AGRICULTURE

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EMPIRE FORESTRY.

OF recent years a most remarkable change has come over the attitude of the British race to forestry. It is not so many years since the only forest service of any magnitude was the Indian Forest Service whereas, to-day, practically every unit, of any size, within the Empire includes such a service amongst its varying activities. The war, in many ways, had a big influence in bringing this about, in that timber is one of the essential raw materials of warfare. The British Isles have always depended on outside sources for their supplies of timber. In time of peace, with a large mercantile marine, there was no difficulty in procuring adequate supplies. The ravages of the submarines during the war put tonnage at a premium. Timber is a particularly bulky article and yet at a time when difficulty was experienced in securing ships for carrying foodstuffs, provision had to be made for large cargoes of timber.

This focussed attention on forestry and led in due course to the establishment in England of the Forestry Commission who in 1920 convened, in England, the first British Empire Forestry Conference. A second conference was held in Canada in 1923 and a third is due to be held in Australia and New Zealand this coming Autumn.

There is no doubt that these forestry conferences have been prominent among the instruments which have helped to effect the transformation in the attitude of the British race to forestry. An important feature of these conferences is the preparation by all units of the Empire of a statement in a prescribed form showing their forest resources, and how they are being handled with a view to future as well as present requirements, due consideration being given to domestic consumption, and to the effect of exports and imports. Parenthetically, it may be mentioned that there are over one-and-a-half million square miles of forest in the Empire and that of this about four hundred and fifty thousand square miles are in the Colonies, lie mainly in the tropics, and constitute about thirty per cent. of the total Colonial Empire.

With the help of these statements the Conferences have been able to visualise the position of forestry in the Empire and have indicated by resolution the main points appearing to require attention. These resolutions have

undoubtedly been of value to many forest services by providing a standard against which to check their activities. As one delegate at the 1923 Conference expressed it "the resolutions of the 1920 Conference are our creed, and confession is good for the soul."

Forests seem destined to pass through three stages, destruction, conservation and economic management.

Up to a point, forests must give way to agriculture and other pursuits and this is fully recognised—it is usually considered, however, that not less than twenty-five per cent. of a country should be retained under forest. This we may describe as legitimate destruction as opposed to wanton or accidental destruction in which fire and shifting cultivation are two of the worst offenders—the former mainly in the temperate regions, the latter primarily in the tropics.

The destruction of forests by lumbering is in a different category. Timber is an important raw material and trees must be felled. Lumbering obviously entails cutting down trees but this does not mean the destruction of the forest if proper regard be had to bringing on new crops for the future.

In Canada, in the five year period 1918-1922 it is estimated that fire destroyed ten million acres of forest with resulting damage in the neighbourhood of fourteen million dollars. In Nigeria it is believed that forest is being destroyed by shifting cultivation at the rate of about two thousand square miles per annum. "Generally speaking shifting cultivation constitutes a serious menace to the well being of the country in which it is practiced. Apart from the destruction of forest wealth as represented by timber, it not infrequently induces a re-growth of less valuable species and vegetation of a more arid type. In the 'recurrent' type of shifting cultivation pressure of population tends to reduce the rest period, and if this is carried too far complete sterility of the soil, whether for forestry or for agriculture, results. This is usually accompanied by denudation of the soil and all its evil consequences."

The examples of Canada and Nigeria are selected as being unfortunately predominant in their respective spheres and it is clear that the period of forest destruction is not ended. It seems equally clear, however, that the present period is one in which the aim is rather forest conservation than forest destruction and that the intrinsic importance of conserving and developing forest resources is becoming more and more widely recognised. As a result areas are being definitely set aside for forestry, and dedicated to the production of timber. Apart from the production of timber, forests—particularly hill forests—play an important part both in safeguarding climatic conditions in the interests of agriculture and in the conservation of water, and the reservation of forest for such purposes has often been the first step in forest conservancy.

Forest conservation, in the sense in which it is here used, is, however, a static condition and implies rather the end of forest destruction than definite economic management.

Whereas, in Europe, the stage of economic management has been in operation, in some cases, for centuries, it is probable, that, if we exclude the last few years, India alone is the one part of the Empire to show any conspicuous advance. Economic management aims at a sustained and increasing yield. In the past forests were often treated very much as mines; they were worked out and then abandoned. The forest resources of the world seemed inexhaustible and a shortage of timber was never seriously believed in, except by the few. Recent investigation has shown that, far from the forest resources of the world being inexhaustible, they are clearly limited and that as far as softwoods are concerned, at the present rate of cutting and destruction, there appears to be less than fifty years supply in sight. Time is the essence of forestry and there is now a growing appreciation that steps must be taken at once to safeguard the future.

It has been stated above that, if we exclude the last few years, relatively little has been done in the Empire in regard to the economic management of forests. On the other hand during the last few years, there has been a big advance and it would not seem unduly optimistic to state that, although destruction still continues and much remains to be done in the way of conservation, there is at long last the beginning of a widespread effort towards economic management.

The natural forest is seldom in a normal condition—that is normal in the forestry sense of the word—and there is usually a deficiency of the younger trees. It takes many years to bring the forest into a condition, in which there are proper supplies of young trees growing up for the future, and to obtain satisfactory results, definite objectives, fixity of purpose and sustained effort are required.

Both the Empire Forestry Conferences recognised that a definite forest policy is essential, the Canadian Conference re-affirming the following resolution thereon, which was passed by the Conference held in England in 1920. "In view of the great importance to the Empire as a whole, as well as to each of its component parts of producing a sustained yield of all classes of timber, of encouraging the most economical utilization of timber and other forest products, and of maintaining and improving climatic conditions in the interests of agriculture and water supply, each of the Governments of the Empire should lay down a definite forest policy to be administered by a properly constituted and adequate forest service."

Forestry and Agriculture are sister sciences and progress in one normally re-acts favourably to the benefit of the other. The recent advance in forestry in the British Empire is thus doubly welcome.

CLEAN MILK PRODUCTION.

BY E. E. MACLACHLAN, M.R.C.V.S.

The Ste. Madeleine Dairy, Trinidad.

[*The primary function of the Company on whose properties the dairy described below has been established is the production of sugar, its crop being in the neighbourhood of* 30,000 *tons per annum. The objects of the dairy are* (1) *to secure the efficient rearing of calves,* (2) *to provide the Staff of the Company with an adequate supply of clean milk and* (3) *to secure an additional supply of pen manure for the Company's fields. Although the production of milk is in excess of its requirements and this surplus is disposed of in the open market, this feature is not a primary object of the dairy and is merely incidental to its other functions. It is important to ascertain approximately at what price, compared with other sources of supply, this clean milk could profitably be placed upon the market, and the Company has promised to supply this information when the accounts are available for an adequate period. At present it is supplied at the same price as from other sources.*—ED.]

IN December, 1926, the General Manager of the Ste. Madeleine Sugar Co., Ltd., decided to start a small dairy to supply milk to the Staff, as the product available from small cow owners, owing to the conditions under which it was produced, could not be regarded as safe; and because calf-rearing on the Estates was becoming increasingly difficult on account of the pernicious system of milking the breeding cows and leaving a portion of the strippings for the calves.

The writer has been asked to give a short description of the Ste. Madeleine Dairy and its work, but before doing this it will perhaps be of value to consider what clean milk really is. In the ordinary sense it means milk in which dirt cannot be demonstrated by the naked eye, but strictly speaking it means milk free from dirt in either suspension, solution or sediment; containing no pathogenic organisms and having a low bacterial count. A realisation of this will make clear the reasons for most of the precautions to secure cleanliness described below.

Buildings.—Part of the mule pen at Petit Morne Estate was partitioned off and designed to make standings for 25 cows. These standings were made of concrete with mangers of the same material in front and a gutter 6 inches deep behind. They have a drop of 1½ inches from front to rear and the gutter slopes sufficiently to carry off the water. They vary about 6 inches in length from one end of the cow shed to the other to provide for cows of different sizes, the idea being to have the hind feet of the cows about 1 inch from the edge of the gutter when standing. The partitions were made in the factory from old rails bent to the proper shape and have proved admirable for the purpose. The cows are tied by chains fastened to the partitions on each side by sliding rings which permit of easy movement perpendicularly and allow the cow to turn her head freely to lick herself but limit movement from back to front, so that the excreta falls directly into the gutter, and thus prevents the hind-quarters being soiled when the animal assumes the recumbent posture.

While this cowshed fulfils the purpose for which it was designed, *i.e.* the production of clean milk, it is only a makeshift and is not considered to be ideal by any means, though the three essentials, impervious floor, light and ventilation are fulfilled. In the tropics it is advisable to have a good high roof with a fairly wide louvre running the whole length and deep eaves. The floor should be of an impervious material (carborundum filings incorporated in concrete are good and prevent slipping) and the cows should be arranged to face the sides with a feeding passage in front and a gutter and milking passage behind. The latter should be wide enough to allow a mule cart to pass. The cows should be tied by the stanchion method and provided with individual water bowls.

The milk-house consists of three rooms in the first of which the milk is weighed and is then poured into a receiving tank placed on the wall 6 feet above the floor. From this tank a pipe passes through the partition into the milk-room proper. These rooms are screened, floored with red tiles and have white glazed tiles on the walls to a height of 5 feet. The third room or wash house is fitted with a "Hygeia" sterilising plant consisting of a boiler, washing sinks and sterilising cabinet (metal). It has an arrangement whereby jets of cold water are forcibly injected into the bottles and also a steam turbine which operates a revolving brush for cleaning them. The building is of re-inforced concrete and has a flat roof on which is placed a water tank which gives sufficient "head" to operate the jets and supplies water for the boiler and cooler. This building and the cowshed are lighted by electricity and water is laid on in the latter for cleansing purposes. There are three airy calf pens which allow of grading the calves according to size.

Cows.—At the start a few of the best milking cows were collected from the Estates and comprised Zebus, cross Red Polls and cross Jerseys together with a few nondescript native cows. These have been mated to a pure bred Holstein bull in an attempt to increase milk production in the progeny. There are now 14 pure bred Holstein cows 12 of which were imported from Canada as heifers in calf and two bought locally. The Ayrshire breeders in Nova Scotia presented us with 2 young heifers and a bull and we have 6 first calf Ayrshire heifers on order from that country. We have also imported a fine Holstein bull which was placed first on the four occasions he was shown. His sire had eight firsts and his dam was a great producer. All these imported heifers have calved safely with the exception of one which is due this month (February). Considering that these

animals are first calvers and in the process of acclimatisation we are well satisfied with their production one of them having reached five gallons.

The possibilities of buffaloes for dairy purposes have hardly been touched in this Colony though they are well recognized in India, Hong Kong and the Philippines. We have two imported cows of the Ram's Horn breed which are good milkers though we do not use them in the dairy. The milk is very rich in butter fat, testing round 12 per cent.

Equipment.—The most up-to-date equipment has been imported. There are milking pails of the "Davies" pattern, *i.e.* covered, though we find it difficult to get the milkers to use these. The milking and carrying pails, &c., are stamped out of one piece and have no seams or crevices in which stale milk or dirt may accumulate and the churns are of the latest pattern. The milk is put up in bottles of imperial pint and quart size and these are sealed with cardboard caps by means of a machine. There is a "Grada" filter and strainer and an "Icykold" cooler also a separator, Gerber tester, special thermometers to ensure that the milk fed to the calves is of the proper temperature, special brushes for scouring the utensils, &c., &c. It is realised perfectly well that good equipment *per se* is not sufficient to ensure the production of clean milk though it is obviously of great advantage to have it. It is the method that counts coupled with constant supervision and if any one wishes an easy job like laying a stair carpet in a bungalow he had better not try producing clean milk in the tropics.

Feeding.—This subject would require a separate article but briefly the cows are fed concentrates according to their production and roughage (Para grass, Elephant grass or cane tops) given *ad lib.* The concentrates used are oats, corn meal, linseed meal, cottonseed meal, coconut meal, wheat bran or pollard, &c. The calves get whole milk for the first 6 weeks and are then gradually changed on to *dry* feed consisting of ground and sifted oats, linseed meal, blood meal, &c. The cows are also fed their concentrates dry as this ensures better mastication and digestion. The system of feeding concentrates made into a swill with two or three buckets of water is not in accordance with a knowledge of the cow's digestive system. Bengal bean meal has been used with very good results and the vine from this bean is excellent for dairy cows if cut before it gets too old. All milking cows and young stock are provided with minerals in the shape of sterilised feeding bone flour imported for the purpose and the others get a mineral mixture.

Milking.—Great stress is laid on milking each cow at the same time each day and on thoroughly stripping the udders. Constant supervision is required to see that these points are properly attended to as nothing will ruin a good cow quicker than disregarding them. The milkers are instructed to milk "dry," *i.e.* not to wet their fingers with the milk. They wash their hands before starting to milk and rinse them between cows, a boy preceding them and going over the udders with a damp cloth. They wear clean smocks and caps, are medically examined once a month and must show a clean bill of health.

Of course the ideal method of milking in the tropics is by machinery, this being now beyond the experimental stage, and though opinion is still divided on the subject it is understood that the Alfa Laval machine is in use in India for Buffaloes, Zebus and European cows, and that a great deal of the milking in Canada, Australia and New Zealand is done by this means.

Health of Cows.—These animals undergo veterinary inspection daily and are tested intradermically with tuberculin every 6 months. Sick animals are immediately removed from the milking herd and their milk is discarded.

Routine.—The milking starts at 2 a.m., a man going ahead of the milkers and cleaning each cow. The cows are then fed concentrates and roughage and are watered and turned out into a paddock at 7 a.m. The cowshed is mucked out and old bedding removed, the whole place being then hosed down. When the standings are dry fresh bedding (trash or megass) is put down and the cows come in at 11 a.m. being watered *en route.* The heavy milkers now get another feed of concentrates with roughage to follow while the others get the latter alone. At 2 p.m. the second milking begins and at 4 p.m. concentrates are fed to all milking cows. They are then watered again and the mangers filled with roughage for the night. Water is offered again at 8 p.m.

The cows are thoroughly groomed and washed if necessary once a day, and the gutter and standings kept clean at all times. They are also sprayed periodically to keep them clear of ticks. Clipping the long hairs on the end of the tail and about the udder helps to reduce the bacterial count.

The milk when drawn is weighed and recorded. It is then passed into the receiving tank in the weighing room and from here it passes into the milk room through a pipe. No person is allowed in here when bottling is going on except those engaged in the work as this obviates opening and closing the door and helps to keep out flies. From the tank the milk passes through the strainer and then through special filtering material. This is a purely precautionary measure as tests with a sediment tester have shown the milk to be perfectly clean as drawn. It passes over the cooler, through which water is constantly running and is then bottled and the bottles capped in the manner previously described.

After these operations are finished all milking pails, feeding pails, churns, tank, pipe, filter, cooler, separator, bottles, &c., are rinsed out in cold water, thoroughly scrubbed in hot water

CLEAN MILK PRODUCTION

(*The article appears on page* 159.)

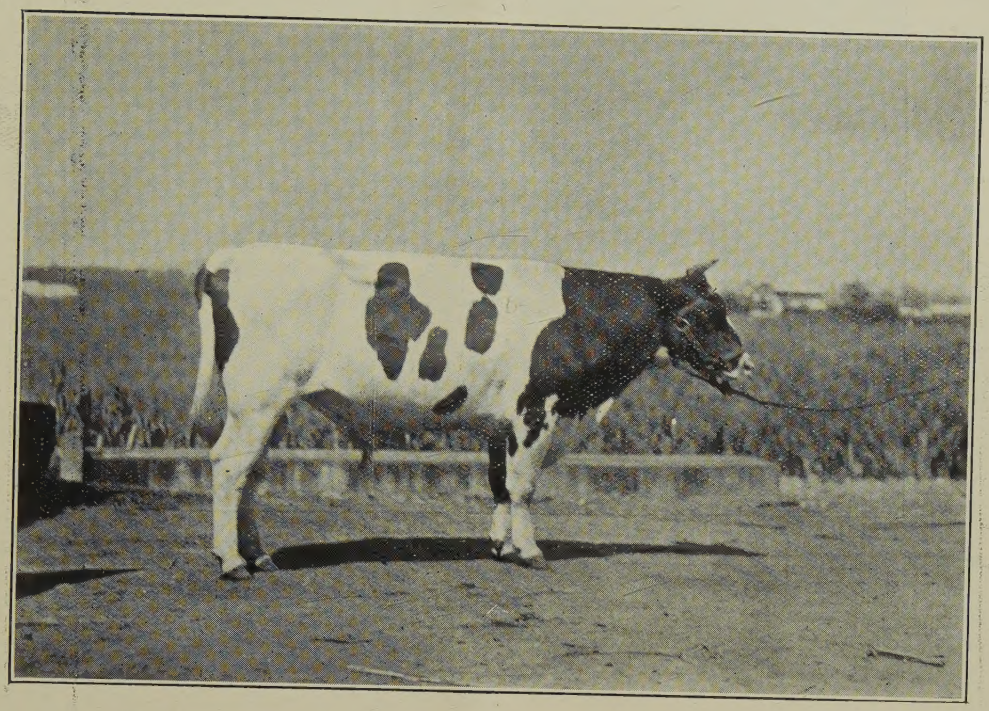


FIG. I—*Captain Rooker Pontiac Jewel.—Pure Bred Holstein Bull.*

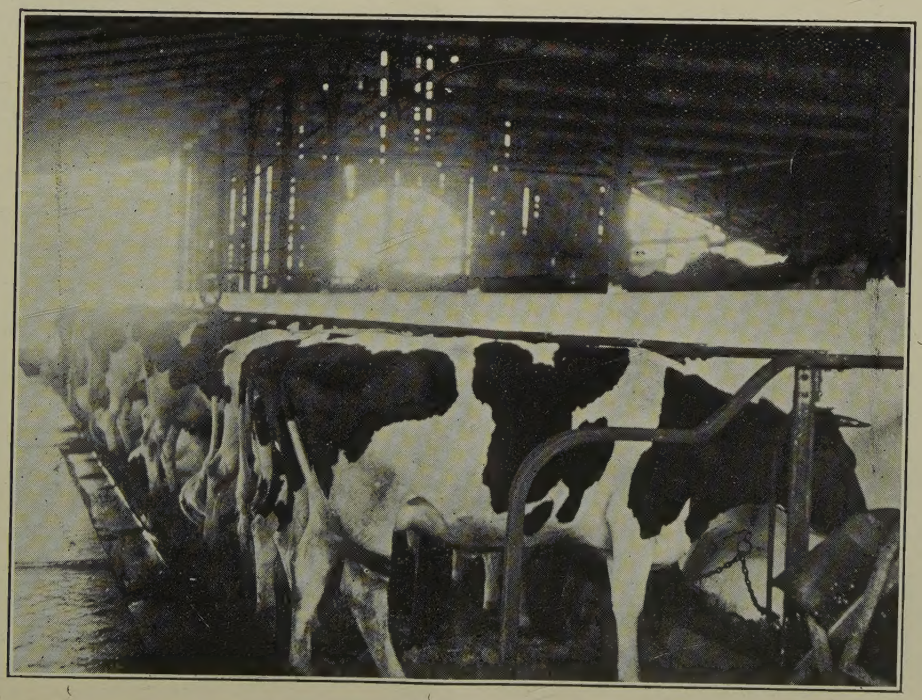


FIG. II.—*Part of Cowshed showing home-made partition (from old rails) and method of tying.*

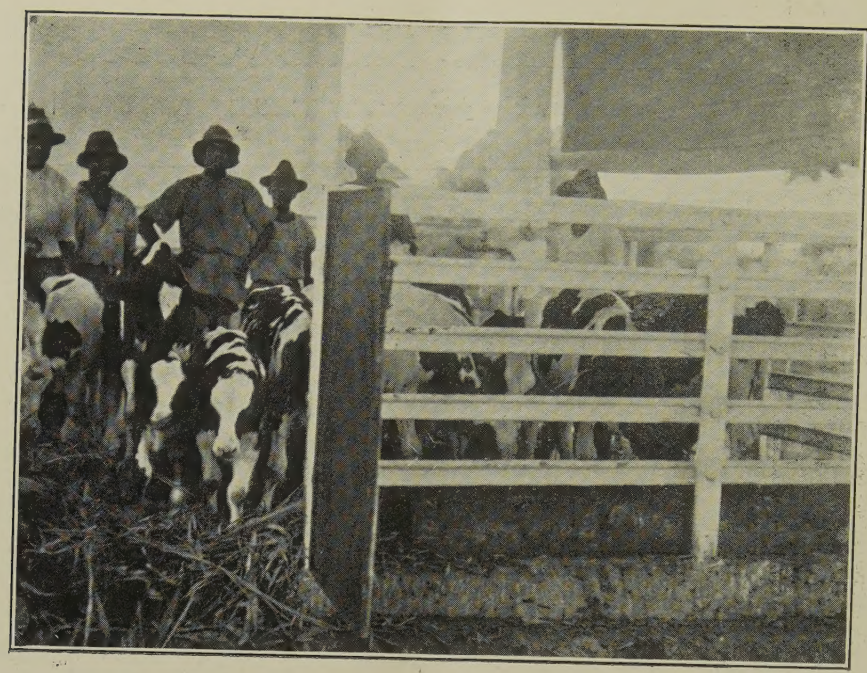


FIG. III.—*Pen of Pure-bred Holstein Calves.*

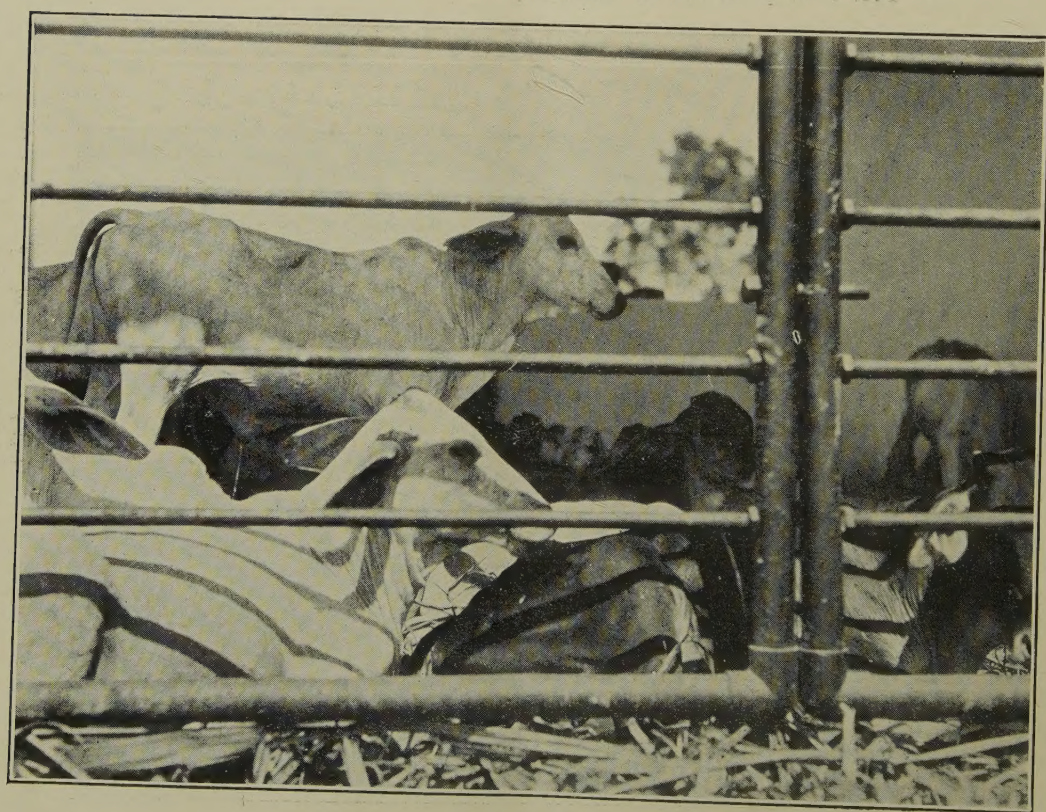


FIG. IV.—*Pen of Zebu and Cross-bred Calves.*

with soda, &c. and the bottles are put on the revolving brush. After rinsing again everything is put into the sterilising cabinet and subjected to steam at 5 lb. pressure for twenty minutes, the utensils remaining here till they are again required.

The milk is sent out twice daily shortly after it is drawn to ensure its being fresh. In order to keep raw milk fresh in the tropics for any length of time refrigeration is necessary. The cooler with water at ordinary temperatures does not cool the milk sufficiently to check bacterial growth. The first consideration in keeping milk is to get the animal heat out of it as soon as possible (if it is not to be separated). It should be cooled to at least 50°F. and kept at this temperature till delivered, but this cannot be done here without some system of refrigeration.

The standard laid down in Britain for the production of "Certified" milk (the highest grade) is that it shall be so produced and treated that on a sample being taken at any time before delivery to the consumer it shall be found to contain :—

(1) Not more than 20,000 bacteria per c.c. and
(2) No coliform bacillus in one-tenth part of a c.c., and also
(3) That the milk shall be bottled at the farm, and
(4) That the cows shall be periodically examined by a qualified Veterinarian and tested with tuberculin twice a year.

It is felt that the Ste. Madeleine Dairy has succeeded in producing milk which may reasonably be termed clean in contradistinction to what has hitherto been the rule in this Colony, and which compares favourably with the standard mentioned above ; also that it may be consumed in the raw state by human beings with safety, and that it is of special value for infants and invalids.

It is not within the scope of this article to deal with the demerits or merits of pasteurisation, but it may be said that no amount of the latter will make dirty milk clean. This process creates a false feeling of security and in any case, if it is to be done it is obviously of great advantage to start with a clean product.

It has been clearly demonstrated that clean milk can be produced in the tropics. Much of the milk which at present reaches the consumer from other sources is dirty, containing a not inconsiderable amount of cow manure and in some cases infected with pathogenic bacteria. Provided that consumers are willing to pay an enhanced price for clean milk there should be no difficulty in meeting the demand.

The following appointments have been made by the Secretary of State for the Colonies during the month of April, 1928 ; Dr. D. Manlove, A.R.C.S., B.SC., A.I.C., Agricultural Chemist, Nigeria. Mr. W. A. Watson, B.SC., Agricultural Chemist, Nigeria.

SUGAR DUTIES.

IN order to safeguard the British refiners from foreign competition between their product and Czecho-Slovakian and American refined which it is said was being dumped on the English market, provisions have been made in the 1928 Budget to reduce the duty on raw sugars between 97° and 98° polarization from 10*s*.9*d*.* to 8*s*. 7*d*. and on 96° crystals from 10*s*. 2*d*. to 8*s*. 1½*d*.—a difference in favour of the home refiner of over 2*s*. whilst the duty on foreign refined, that is sugar over 99°, remains at 11*s*. 8*d*. per cwt. The Empire Preference and Excise rate on sugars over 99° is reduced from 7*s*. 4¾*d*. to 5*s*. 10*d*—almost 1*s*. 7*d*. per cwt. ; on sugars between 98° and 99° to 4*s*. 9*d*.—2*s*. 7½*d*. difference ; and on sugars between 97° and 98° from 6*s*. 9½*d*. to 4*s*. 7¾*d*.—a gain in preference of 2*s*. 1¾*d*. British refiners have agreed in return to lower their prices of sugar to the consumer by ¼*d*. per lb. for the next three months. While a permanent lowering of retail prices is not guaranteed by the Government they hope that by their reduction of the duty on raw sugar an additional 600,000 tons of refined sugar will be produced at the British refineries, whose output of refined had almost remained stationary during the last seven years at the expense of foreign imports which had increased from 181,000 tons to 712,000 tons in 1926 and to 561,000 tons in 1927.

It is generally expected that the market for foreign refined will drop considerably. Foreign sugar producers will have either to cut their prices down by over 2*s*. for refined or to revert to the pre-war practice of shipping raw beet sugar. The new scales of English duties are viewed with alarm in Czecho Slovakia as they will naturally exercise a serious effect on the country's raw sugar manufacturers and beet growers. It is stated that Czecho-Slovakian refined sugar exports amounted to 137,167 tons in 1927. Empire growers should benefit by the change as the ½ million tons of foreign sugar which may be shut out of the English market will have to be replaced by home refined or Empire whites, and it is anticipated that the home refiners in conjunction with the Sugar Federation will meet their requirements in the first instance by buying Empire raws. The new fiscal measures have not been seriously opposed, but many letters have appeared in the Press, the gist of which was that a reduction in the duty on raw sugar without a similar reduction on refined sugar would lead to grave disturbances in the business of Mincing Lane, and put the trade and the home beet sugar industry at the mercy of a few sugar refiners. It is quite clear that the position of those brokers who till now had many buyers of the refined article will suffer at least a temporary extinction, while those who supplied the refineries in raws will be able to continue business although even the latter will be dominated by leading refiners.

G. G.

* Fractions of a farthing have been ignored.

ST. VINCENT ARROWROOT.

By G. Wright, B.Com.

St. Vincent is the principal source of supply of arrowroot and the product takes an important place amongst the island exports. Its relative position amongst the other exports will be readily appreciated from the following list of exports and values in 1925 and 1926.

	1925.	1926.
	£	£
	(57,000)*	
Arrowroot	125,078	45,807
Cassava Starch	4,160	4,077
Cotton :		
Sea Island	57,655	63,175
Marie Galante	464	1,514
Seed cotton, Marie Galante	1,047	468
Cotton Seed	53	398
Cotton-seed oil	1	583
Cocoa	2,345	2,461
Syrup and Molasses	19,672	16,523
Copra	5,512	9,826
Peanuts	3,794	2,370
Animals	3,986	5,243
Whale oil	1	148
Vegetables, Fresh	2,581	2,107
Peas	866	476
Corn	627	388

Although arrowroot succeeds best on loose and sandy soils, fairly good results are obtained in many districts with an undoubtedly clayey soil. The crop is less particular in its soil and climatic requirements than cotton and consequently the area over which it could be grown is relatively great. Extension of production could easily be undertaken, but past experience has shown that such extension brings about an accumulation of stocks in the hands of brokers, and consequently, low prices. In the language of economics a point is soon reached at which demand becomes inelastic—an increase in supply brings about a more than proportionate fall in price.

Up to about 1888 the industry was in a fairly prosperous condition, but later a depression was felt and ascribed largely to a falling off in the quality of the starch. At that time fair quantities of arrowroot were also made in Natal, smaller quantities in India, Fiji and Queensland, and the best quality came from Bermuda.

In 1892, the value of arrowroot starch exports was £61,313, by 1896 it had fallen to £20,506 the lowest value since 1880, and the West Indian Royal Commission of 1897, called attention to its depressed condition.

* (*Colonial Report* (1372), 1928)—£125,078 is an error.

Until 1910, the position of the industry was regarded as unsatisfactory, but some improvement was then effected by the inauguration of an association for price control—the Arrowroot Growers' and Exporters' Association. In 1911-12 the Association agreed not to sell arrowroot in the United Kingdom at less than 2*d.* per lb., gross and in 1912-13, the minimum price was raised to 3*d.* per lb. At the same time it was decided to advertise the product and endeavour to obtain new markets. To finance the propaganda a cess of 6*d.* per barrel was collected on exportations. Arrangements such as these depend on the solidarity of members for their success and two forms of defection were noted (*a*) the exporting of arrowroot starch as cassava starch to avoid the cess and (*b*) the exporting in 1912-13 of large quantities of low grade arrowroot.

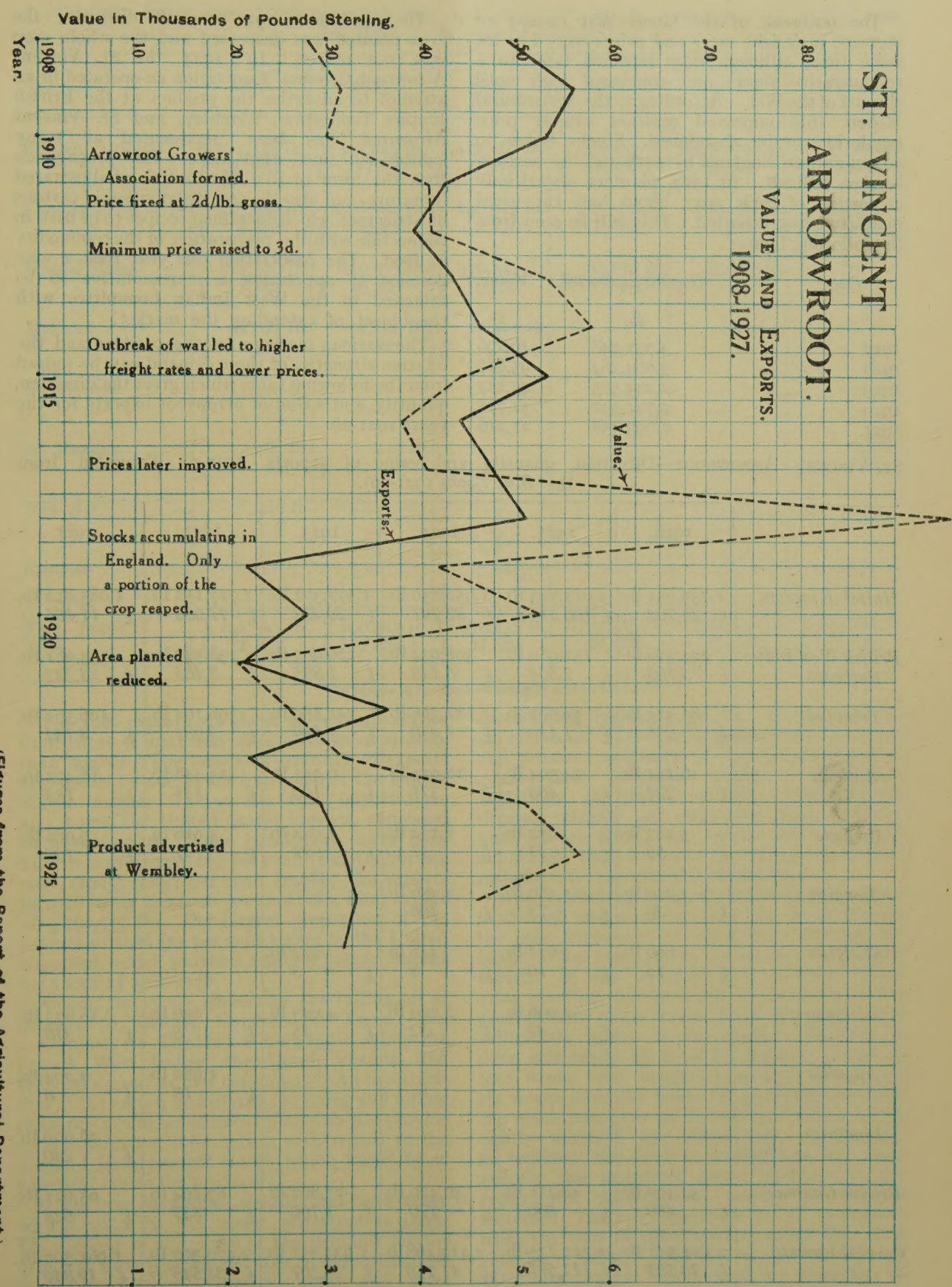
The position of exports and their value during the last twenty years will be made clearer by a reference to the following table and graph which give the statistical history of the crop from 1908-27.

Arrowroot—Production and Value 1908-1927.

Compiled from the Agricultural Department Report.

	Arrowroot.	*Value.*
	lb.	£
1908	4,886,379	27,713
1909	5,594,098	31,792
1910	5,302,725	30,089
1911	4,254,130	40,430
1912	3,948,641	40,854
1913	4,327,036	53,607
1914	4,618,347	57,806
1915	5,290,781	44,689
1916	4,441,242	37,619
1917	4,737,548	40,296
1918[1]	5,084,262	95,828
1919	2,244,575	42,222
1920	2,794,532	52,771
1921[2]	2,093,358	21,216
1922[3]	3,627,401[4]	26,141
1923[5]	2,177,183	31,829
1924	2,952,535	51,361
1925[6]	3,189,740	57,000
1926	3,291,533	45,807
1927	3,164,118	—

1. Stocks accumulating, only a portion of crop reaped.
2. Area planted decreased and whole not reaped. No price fixing by Association.
3. No price fixing.
4. The St. Vincent *Blue Book* puts the export figure for this year at 2,692,130 lb.
5. Good demand.
6. Canadian-American shipments growing.



(Figures from the Report of the Agricultural Department.)

The outbreak of the Great War caused an increase in freight rates and prices were low for some time, although they returned later to a remunerative figure and continued high until the end of the War. According to the Agricultural Report this improved position caused price regulation to be abandoned. Stocks began to accumulate in England by 1918 and the position became difficult. In 1919, planters reaped only a portion of their crop, about half the usual quantity being exported. This will be seen from the following figures:

Date.	*Quantity exported.*	*Value.*
	lb.	£
1917	4,737,548	40,296
1918	5,084,262	95,828
1919	2,244,575	42,222
1920	2,794,532	52,771
1921	2,093,358	21,216

The position in 1921 was still difficult; the area planted was decreased and the whole crop was not reaped. In 1924 the St. Vincent Arrowroot Growers' Association co-operated in an attempt to advertise the product at the British Empire Exhibition, Wembley, and St. Vincent Arrowroot has been represented at many exhibitions since that date. The propaganda took the form of free distribution of illustrated literature, and also the free distribution of cartons of arrowroot which contained recipes to be used in connection with the preparation of the commodity as food. The Association this year took a wise decision in appointing a representative to be attached to the West Indian Committee with the object of extending the market.

The various markets for the product and the relative strengths of their demand can be judged from the following table which gives the direction, quantity and value of arrowroot exports for the years 1921-26.

ST. VINCENT ARROWROOT—Direction, quantity and value of exports, 1921-26 (Compiled from the *Blue Books* 1921-26).

	1926.	1925.	1924.	1923.	1922.	1921.
United Kingdom	1,739,054 lb. £ *25,704*	2,017,723 lb. £ *106,517?*	1,952,830 lb. £ *32,797*	1,577,372 lb. £ *23,432*	1,727,152 lb. £ *17,058*	1,085,812 lb. £ *11,105*
British West Indies: *Barbados*	244,916 lb. £ *3,103*	152,980 lb. £ *2,564*	308,932 lb. £ *6,145*	126,903 lb. £ *1,855*	238,547 lb. £ *2,465*	333,081 lb. £ *3,242*
Trinidad	83,515 lb. £ *938*	74,007 lb. £ *1,150*	82,306 lb. £ *1,450*	141,889 lb. £ *1,689*	396,164 lb. £ *3,981*	406,562 lb. £ *4,134*
Antigua	16,144 lb. £ *224*	24,304 lb. £ *403*	18,924 lb. £ *371*	6,914 lb. £ *100*	13,448 lb. £ *131*	18,472 lb. £ *183*
Grenada	5,183 lb. £ *59*	672 lb. £ *11*	2,132 lb. £ *37*	2,044 lb. £ *27*	4,916 lb. £ *47*	9,982 lb. £ *105*
Jamaica	2,240 lb. £ *30*	4,480 lb. £ *75*	4,256 lb. £ *106*	....	....	....
St. Kitts	896 lb. £ *15*	672 lb. £ *10*	448 lb. £ *8*	224 lb. £ *3*	....	....
St. Lucia	....	2,996 lb. £ *47*	2,220 lb. £ *32*	4,043 lb. £ *55*	896 lb. £ *8*	18,673 lb. £ *210*
Anguilla	....	....	....	....	1,980 lb. £ *18*	2,204 lb. £ *6*
Dominica	....	....	....	....	....	20,900 lb. £ *230*
British Guiana	32,400 lb. £ *480*	44,411 lb. £ *800*	40,420 lb. £ *770*	73,862 lb. £ *1,106*	87,294 lb. £ *837*	65,621 lb. £ *625*
Carried forward	2,124,348 lb. £ *30,553*	2,322,245 lb. £ *111,577*	2,412,468 lb. £ *41,716*	1,933,251 lb. £ *28,267*	2,470,397 lb. £ *24,545*	1,961,307 lb. £ *19,840*

ST. VINCENT ARROWROOT—Direction, quantity and value of exports, 1921-1926. (Compiled from the *Blue Books* 1921-26.)—*Contd.*

	1926.	1925.	1924.	1923.	1922.	1921.
Brought forward	2,124,348 lb. £ *30,553*	2,322,245 lb. £ *111,577*	2,412,468 lb. £ *41,716*	1,933,251 lb. £ *28,267*	2,470,397 lb. £ *24,545*	1,961,307 lb. £ *19,840*
Canada	225,949 lb. £ *3,373*	206,542 lb. £ *3,043*	146,544 lb. £ *2,420*	181,080 lb. £ *2,582*	166,645 lb. £ *1,138*	131,155 lb £ *1,367*
United States	914,379 lb. £ *11,568*	649,977 lb. £ *10,263*	376,843 lb. £ *6,658*	62,852 lb. £ *980*	55,088 lb. £ *458*	....
Holland	22,621 lb. £ *256*	11,200 lb. £ *188*	22,400 lb. £ *560*	....	....	....
Guadeloupe	1,344 lb. £ *17*	....	....	....	....	....
St. Martins	2,464 lb. £ *32*	448 lb. £ *7*	....	....	....	896 lb. £ *9*
Bon Air	448 lb. £ *8*	....	....	....	....	....
Curacao	....	....	280 lb. £ *7*	....	....	....
Total Trade	3,291,553 lb. £ *45,807*	3,190,412 lb. £ *125,078* ?	*2,952,535 lb. £ *51,361*	2,177,183 lb. £ *31,829*	2,692,130 lb. £ *26,141*	2,093,358 lb. £ *21,216*

* The figures in the Column actually add to 2,958,535.

The 1926 exports are about 50 per cent. higher than those of 1921 and their total value is more than double. The increased quantity of exports appears to be due to the extension of the United States market. Taking the 1922 importations as a basis, the United States imports, expressed as a percentage of the basal year, have been 112 per cent. (1923), 673 per cent. (1924), 1,161 per cent. (1925), 1,633 per cent. (1926); the exports in 1926 being about 28 per cent. of a total export of 3,291,553 lb. The largest proportion of the exports in 1926 (53 per cent.) went to the United Kingdom, which provides a pretty steady market for about 1¾ million lb.

Among the minor consumers the falling off of exports to British Guiana, St. Lucia, and particularly to Trinidad is noticeable, while the French West Indies, the Dutch Islands, and Holland appear as new consumers. An investigation of the causes underlying the rising and falling of markets in these different places should provide some interesting information with regard to the demand for arrowroot starch which might be of practical use to the producers.

It has been mentioned already that the acreage which could be put under arrowroot is large. On account of the state of the demand for the product, however, the acreage under cultivation is much smaller. Current prices and price prospects in relation to cost of production are a determining influence on the acreage planted or 'ratooned.' The crop is grown by both estates and peasants and some of the Land Settlement Areas have factories attached. There are variations in quality of the product—grade depends largely on whiteness—and the high qualities are found on estates with a natural advantage like clean water combined with clean manufacture and efficient organisation.

Where planting is being undertaken, the land is cleared and hoed up—the hoe is practically the sole implement of cultivation through the island. Top roots of the tuber are then lightly buried. In wet weather, two or three weeks after planting, leaves begin to show above the ground and three weeks later the plants are sufficiently grown to be weeded. Weeding is done principally by hand by women. Three to four weeks later supplying is done and about six weeks later the fields again require weeding, the weeds being left on the surface and the plants lightly moulded up. After this, at intervals as required, the land is weeded and the more quickly the arrowroot grows and covers the ground the smaller the number of weedings required. The crop ripens in 10 to 12 months from the time of planting and shows that it is ripe by "falling", that is, the leaves dry and the stalks bend at the root till the whole lies on the ground. Some fields mature sooner than

others, eight months of growth being in some few places sufficient for maturing. In reaping the labourers are put in the field with hoes and they dig out the roots breaking off the top joints and burying them as plants for the succeeding crop. This system of 'ratooning' is often allowed to run on for considerable periods. The roots are afterwards measured, collected and carted to the mill for manufacture.

The return per acre could be reckoned in terms of baskets of roots dug, but a better idea is given by the number of barrels of starch and this depends on the weight of the roots and their starch content. The starch content varies according to the age of the arrowroot, and, unless it is mature, poor yields are likely to be obtained. The lifting of the crop has to be fitted in with the estate routine and this often prevents digging at the optimum stage. When the acreage is large reaping has to be started in certain estates in October in order that the crop may be taken off before the spring. On others it is necessary to make an early start so as to obtain sufficient water for power and manufacturing purposes.

Yields are said to vary from 5 to 20 barrels of 220 lb. of arrowroot starch per acre. One prominent planter is of the opinion that the average yield over the whole island is 8 barrels per acre.

On the arrival at the factory, the arrowroot rhizomes are washed and cleaners scrape off the roots. The washed rhizomes are passed on to the millman who feeds them against a revolving saw grater. This is usually a section of the trunk of a tree about 18 inches to 2 feet in diameter, with slits parallel to the axis of the block, in which saw blades are inserted. The swelling of the block when wet holds the blades firmly. The disintegrated arrowroot falls below the wheel and is from time to time again fed to the grater. After the second feeding the shredded mass is put on to the first strainer which is a tray having wire netting at the bottom. Running water passes over this and as the "first strainers" (women labourers) knead the mass with the water, the arrowroot starch passes through the sieve leaving behind the "bittie" (the fibrovascular bundles remaining after extraction of the starch). Straining is completed through second and third sieves with netting of progressively smaller mesh and the water with arrowroot in suspension then passes into a long shallow bath or settling cistern. On one estate visited by the writer this bath was lined throughout with white glazed tiles; such a construction tends to avoid the accumulation of slime and to result in a whiter—higher grade—starch. Later, the water is run off, the starch dug out, again mixed with water and passed through a fine sieve into separating vats where it is energetically stirred and then left to settle. The vats are small and round (about 3 feet in diameter) with smooth perpendicular sides and are sometimes lined with white glazed tiles. After settling, the water is drained, the impure starch on top scraped off and the clean wet starch below "headed" to the drying house. After being allowed to drain and harden for some time, handsfull of the starch are put on trays of wire netting of open mesh which are arranged in tiers in the drying house and as the starch dries it crumbles and falls on to a wooden tray at the bottom of the wire trays. It is then graded according to degree of whiteness and barrelled. The drying house is open on all sides to quicken the drying and is surrounded with wire netting to keep out birds.

As will be deduced from the above account the manufacture of arrowroot starch is a relatively simple process and does not need very expensive equipment. Most of the present buildings in St. Vincent are very old, and beyond graters, sieves and tiles, little is needed in the way of replacements. Usually the motive power is provided by water wheel and the water is led to the wheel by flumes constructed long ago. The factories range in capacity from 10 to 20 barrels a day, employ 15 to 35 workers, and cost 20*s.* to 35*s.* a day to operate.

So far as costs of production are concerned it is difficult to get anything beyond prime cost. Costs per acre naturally vary. Although costs to reaping are much the same on all estates, differences of yield cause differences in cropping and manufacturing costs. The cost figures given to the writer were confidential, but the following figures for percentage distribution of total prime cost per barrel of arrowroot starch amongst cultivation operations, cropping, and manufacturing may be interesting.

'RATOONED ARROWROOT.'

Percentage distribution of total prime cost per barrel.

	1 per cent.	2 per cent.	3 per cent.
Outlay to cropping time....	37.6	48.8	37
Cropping	23.8	21.7	26
Manufacture	38.6	34.5	37

The bittie taken from the strainers and the dirty starch from the top of the settling vats are not wasted. The latter is given to labourers as a perquisite or fed to pigs and poultry. At present, the former may be directly applied as a manure, used for bedding and making pen manure, or given as a foodstuff to cattle. As a result of a suggestion that this material could be used for paper making, a test was made by the Imperial Institute and the following note is to be found in the Agricultural Report for 1925, "the amount of caustic soda consumed in the process of digestion is unusually high. Although the pulp bleaches fairly readily the paper furnished by the unbleached pulp is of an unsatisfactory character." Subsequently inquiries were also made into the possibilities of bittie as a source of industrial alcohol—an abstract of the report will be found in the same publication of the Agricultural Department, but no view is given on the economic side of the question.

A TRINIDAD PLANTATION.

A Century's Vicissitudes.

BY SIR NORMAN LAMONT, BT.

THE connection of the Lamont family with Naparima dates from the early years of the Nineteenth Century, when John Lamont came out from Scotland, a penniless younger son, and after learning the practice of sugar planting in the usual way, as overseer and then as manager, acquired in partnership with John Corrie the sugar estate of Cedar Grove. In 1819 John Lamont bought the "undivided moiety" of his partner for the sum of £28,750. Now the said estate of Cedar Grove consisted of 360 acres, so the value of the whole estate, as between a willing seller and a willing buyer, was £57,500 or £160 per acre. This of course comprised the residence, sugar works, slaves and livestock.

That even on such a capitalisation sugar growing was profitable is proved by the fact that only two years later, in 1821, John Lamont was able to start his brother Boyden on the adjoining estate of Canaan (320 acres); while in 1829 he added the 120 acres of La Grenade for £13,000 to his own estate of Cedar Grove.

Boyden Lamont died in 1837, and John henceforward owned a compact block of 800 acres in Naparima. He also acquired the River Estate in Diego Martin, then a sugar estate with a mill worked by water power, and a few years before his death he bought the estate of Benmore in his native Argyllshire.

John Lamont died in 1850, and the estates passed to his nephew James, afterwards Sir James Lamont, Baronet of Knockdow. The new owner adopted a policy of agglomeration. In 1859, Belair, 251 acres, was annexed to Canaan for the price of £10,000. In 1869 the distant River Estate was sold for £8,000, and the 361 acres of Palmiste acquired for a similar sum. Palmiste bounded with Canaan, had good shipping facilities at the mouth of the navigable Cipero River.

In 1874, Philippine and Champ Fleur (460 acres) were added to the group. Values were steadily falling, for the price of £21,000 was considered a very high one. But the soil of Philippine, at least, was exceptionally fertile, and the new acquisition rounded off the estate.

Lastly in 1892 the Palmiste group of estates, as at present constituted, was completed by the purchase of La Ressource. The value of land had now apparently reached rock-bottom, for this estate of 256 acres is the most fertile of the whole group, if not of the district, and the price paid was only £2,350. This included 18 excellent mules, a large residence, labourers' barracks, and a small centrifugal sugar factory with some entirely new machinery.

Down to the year 1883 sugar was made by the muscovado process at small "works" situated on each of the four estates, Cedar Grove, Canaan, Palmiste and Philippine. Even this was a result of previous amalgamations, La Grenade, Champ Fleur and Belair having each originally manufactured its own sugar. Belair, indeed, itself had had two separate sets of works, in which cane was ground between the vertical rollers of ancient cattle mills.

It may not be out of place here to remark that the amalgamation of the sugar estates of Trinidad has been a marked feature of the last forty years, and has entirely altered the landscape of the three "sugar belts" of the Colony. When the present writer first visited Trinidad during the crop of 1889, there were no fewer than 88 sugar factories in operation. Their outputs varied from Champs Elysées with its 8 tons up to the Usine Ste. Madeleine with its 6,100. The country side was dotted in every direction with little sugar works, each with its smoking chimney, and its yard filled with half-crushed canes laid out to dry in the sun. The smell of muscovado sugar was carried on every breeze. Each of the 88 factories, moreover, was dependent on the existence of a good supply of clear water with the result that a pond, or two ponds, sometimes of considerable capacity, had to be carefully maintained and annually cleaned out, thus supplying this necessary of life to the population of waterless Naparima. One of the less happy consequences of centralization has been the abandonment of the majority of the ponds, and the annual recurrence of a water famine.

It is interesting to observe that in 1889 the 88 factories produced 66,762 hogsheads of sugar, equal to 53,410 tons. In 1927, 13 factories, including St. Augustine, produced 51,982 tons. It is a fairly safe prediction that 40 years hence, as a result of further amalgamations, there will not be more than 3 factories, and that St. Augustine will be one of them.

But to return to the vicissitudes of Palmiste. By the year 1883 the high profits of the good old days had departed for ever, and were being replaced by heavy annual losses. The heroic policy was accordingly adopted of erecting a central factory for the group, to make crystallised sugar by the most modern methods. This factory was erected near the shipping place on the Cipero River in time for crop 1884, at a cost of £26,600. And a few years later £8,000 was spent upon five miles of tramway for bringing in the cane. This was effective, for a time, in stopping the rot, and from 1887 to 1893 varying profits were made. The price of sugar, however, as well as profits, still tended downward; and in 1894, in the endeavour to reduce the cost of production, it was resolved again to modernise the factory, and £18,000 were spent on double crushing plant, a larger triple effect, another vacuum pan, and other machinery.

In the light of subsequent experience, it is easy now to see that this was a mistake. The price of sugar went on steadily falling, and the increased extraction of sugar never had a chance

to pay the interest and amortization on the new capital. It would have been wiser to close the factory, and to abandon cane-growing. For in the fourteen years from 1894 to 1907 a profit (sometimes very small) was only made on five crops, while the total losses on the other nine were enormously greater.

During these same disastrous fourteen years there was scarcely a sugar factory in Trinidad which did not change hands, because of financial difficulties, due to the continuous losses they incurred.

Better late than never, it was decided to abandon sugar in 1907. But a fresh difficulty arose. Sir James Lamont held that the right course was to sell the estate as a going concern. Disheartened by continual losses on so large a scale, and sceptical as to the probability of other crops being any more remunerative than cane, even after an uncertain and anxious period of speculative expenditure, he was unwilling to continue. He accordingly made over the estates to his son, the present proprietor, who was reluctant to sever the long connection of his family with the estates, without another attempt to save them.

The difficulty of the new owner then became how to raise the capital necessary for further endeavour. Recourse, no doubt, might be had to the distressing and almost universal Trinidadian custom of raising a mortgage on the property. But in this case it seemed sounder finance to sell the sugar factory. This was done, and it provided a fund of £5,000 wherewith to proceed in planting other crops. The cane went on ratooning for varying periods in different fields, and was sold to adjacent factories. As the ratoons died out, the land was either put under other crops, or rented out to cane farmers. The revenue from rents has, of course, been all-important in tiding over the change from cane, an annual crop, to crops taking many years to come to maturity, and in enabling experiments to be made.

For the decision wherewith to replace cane was a problem as difficult as it was important. There was nothing to guide one: no previous experience to go by. Nothing but cane had, at that time, ever been grown in or near the district of Naparima. It would have been absurd to contemplate planting cane for sale to other factories, seeing that the price they offered then left no margin of profit even to farmers, working with their own hands, and taking no account of the value of their own labour. Sugar planters and cacao planters alike were unanimous in deriding the idea that cacao could be successfully cultivated on the old cane lands of Naparima. The soil was obviously too heavy to be ideal for coconuts. After the severe losses of the preceding period, it would have been extremely rash to plunge into heavy outlays for planting large areas of any one crop. It was prudent to go slowly, and to watch results. Mistakes might be made, and were made. But they were not financially shattering, as the losses in sugar had been.

Let us clear the ground first of the mistakes. In 1907 the rubber boom in the East was approaching its height, and there was a strong temptation to try to grow rubber also in the West. Unfortunately the Royal Botanic Gardens of Trinidad, had made themselves responsible in 1899 for the pronouncement that "*Castilloa* promises the best of any of the rubber so far for local cultivation." This opinion was emphasised in 1902 by the recommendation of the Imperial Commissioner of Agriculture that *Castilloa* is "the best rubber tree to cultivate in the West Indies." This advice was widely followed with deplorable results, as may still be seen from the wreckage of *Castilloa* plantations throughout Trinidad. Palmiste was no exception, and several fields were planted with this "noxious arborescent weed." *Hevea* rubber was also tried on a small scale, and equally failed. For this crop the rainfall of Western Trinidad is inadequate and the prolonged dry season fatal to success.

In 1907 also Trinidad was experiencing one of these periodic outbursts of eagerness for the creation of a fruit industry—outbursts to which it has been liable ever since 1889. It was fortunate that at Palmiste enthusiasm did not extend beyond planting half-a-dozen fields in bananas, about equally divided between "Governors," and "Gros Michel." With no possibilities of irrigation, it proved impossible to obtain a sufficient proportion of nine-hand bunches to make this a paying proposition. These fields therefore were under-planted with cacao and "immortelles," and the banana plants justified themselves as temporary shade.

A third failure was an attempt in 1911 to grow cotton. Twenty acres were planted in Sea Island and Thornton's Hybrid. Both the quantity and the quality of the lint, especially the Hybrid, would have been moderately satisfactory, but for the immense proportion of it rendered worthless by stainers and boll-weevil. Large gangs of children were employed daily in collecting the stainers, but it was found impossible to cope with the incessant influx of stainers from *Malachra capitata* L., one of the most abundant weeds throughout Naparima, and a natural food plant of the stainer.

An experiment was made in 1914 in the cultivation of cassava. A Liverpool firm had rented the shell of the old Palmiste factory, and had installed there elaborate machinery for the manufacture of cassava flour. Various neighbouring estates undertook to grow certain experimental areas of cassava. But the Naparima clay was too stiff to allow the tubers to develop as they should. The yield of cassava per acre in no case covered the cost of cultivation.

Finally, in 1915, three fields were planted in limes. These trees throve remarkably well, but in the very year in which they were due to come into bearing, the fatal wither-tip disease smote the island. No effectual preventive or remedy has yet been found.

Turning now from the failures to the successes, the largest area is under :—

Coconuts :

Encouragement in 1909 to attempt the growing of coconuts was afforded by the presence at Alley's Creek of a fine group of prolific palms, known to have been in existence prior to 1865, when the old estate house in this vicinity was occupied by the father of the present proprietor. Planting was accordingly first done on the adjacent areas, which had the reputed advantage of proximity to the sea.

In the event the soil has proved far too heavy for the ideal growth of this crop. Growth, though steady, has therefore been slow, and the palms only come into bearing at about 14 years old. The capital expenditure involved, without return, in so long a period of waiting would have been fatal, had it not been for the fortunate discovery that sugar-cane and coconuts grow quite harmoniously together, the palms indeed benefitting from the tillage given to, and side-shade given by, the annual crop. Cane farmers were found to be willing to allow the nuts to be planted through their holdings, receiving at the end of five years 1s. per tree, or about 77s. per acre for which they would, during the same period, have paid about £5 in rent. This arrangement suited both landlord and tenant, and materially reduced the period of unremunerative outlay on the coconut cultivation : as compared with "ring-weeding" a space around each nut in a jungle of "rastrojo" or secondary bush. Keeping each acre clean weeded during the growth of 77 nuts from infancy to maturity would of course have been ruinously expensive in money ; while from the agricultural point of view, the tropical rains would have "washed" all plant-food from the naked soil into the sea long before the period of maturity arrived.

After "taking over" from the farmers, the principal expenditure is involved in deepening the drains, round-ridging the beds, sowing a cover crop, and periodically cutlassing the weeds which are left to rot as a mulch. Various artificial fertilizers have been tried, in order to accelerate growth—entirely without effect.

The only disease which has so far given any trouble is "red ring"—cases of which are promptly treated by spraying with crude-oil and burning.

Otherwise the palms appear healthy, and one has been counted to give the very exceptional yield of 158 ripe nuts at a single picking. The fields are steadily coming into bearing, year after year, and the crop of copra correspondingly increasing.

Coffee :

Coffee (*C. arabica*) has been grown for many years at Palmiste in quantity sufficient for estate consumption. The yield has been fair and the quality quite good. From 1916, gradually increasing quantities have been available for sale.

In recent years the Department of Agriculture has introduced, and grown for distribution on a large scale, plants of *C. robusta* and *C. excelsa*. A considerable acreage of these, with some few *C. liberica* and *C. stenophylla*, are now in bearing at Palmiste. All withstood without loss of life the great drought of 1926. *C. excelsa* has since then suffered from a severe attack of *sclerotia*. Otherwise all seem to thrive.

The produce of these coarser and more prolific kinds is very deficient both in flavour and in aroma, but it is still able to find a ready market as "coffee."

Cacao :

But of all the crops tried cacao without question has been the outstanding success. The universal opinion of the pundits has been wrong, and it is questionable whether anywhere in the island there is a finer stretch of cacao than in the valley of La Ressource. There is practically no disease. The whole area at Palmiste came through the great drought of 1926 without losing a single tree. Crop 1927, elsewhere a poor one, was at Palmiste a "record." Crop 1928 bids fair to beat even the bumper-yield of the previous year.

The area under cacao is being slowly, but steadily, extended. And in the light of experience it is now only to be regretted that the acreage devoted to various experimental crops was not planted exclusively in cacao.

Another factor in enabling the estate to be successfully re-established upon its new basis has been land settlement. Not only has the rental received from the cane farmers continued to be an important item in the revenue of the estate, but the leasing of certain areas of land for "house lots" or building sites, has also been a source of income. In all, 354 of such "house lots" have been rented out, grouped into six villages. This has created a reservoir of labour which can be drawn upon at will to supplement the supply, now of very modest dimensions, housed in the "barracks" of the estate.

The future no one can foresee ; but the estate is now, and has for several years past been, considerably more than self-supporting. If no disaster befalls, then, as the large area of coconuts comes steadily to maturity, so should the margin of profit annually increase. It is therefore not unfair to claim that the bold experiment has been justified, of changing, against all expert advice, from sugar manufacture to mixed cultivation.

This opinion is fortified by the consideration that of the ten larger sugar estates, with factories making 3,000 tons and upwards, existing in 1907, Palmiste is the only one remaining now in the same ownership. The others, still manufacturing sugar, have changed hands. Some have undergone drastic financial reconstruction. Perhaps, indeed, it was only the high prices of sugar in the boom years during and just after the war, that saved some of them from an even worse fate. Their ownership has been altered, that sugar may remain. At Palmiste, on the other hand, sugar has been abandoned, but the ownership remains the same. A proprietor attached to his estate may be pardoned if he regards this outcome of the long struggle with a modest satisfaction.

STUDENT INVESTIGATIONS.

The following is a list of some of the papers prepared by students while in residence at the College. These are available in the College Library for reference.

1923-1924.

J. C. HOPKINS, B.SC. (Lond.) ..	..Notes on a Soft Rot of Cotton in the West Indies caused by a Species of *Phytophthora*.

1924-1925.

W. C. LESTER-SMITH, B.A., Dip. Agr. (Oxon.)	..Some observations on the Oospores of *Phytophthora* species. (Reprinted from *Annals of the Royal Botanic Gardens*, Peradeniya, Ceylon, Vol. 10, Part 3.)
J. W. COWLAND, B.A. Dip. Hort. (Cantab.)	..(1) A description and short notes on the Sweet Potato Pyralid Moth. (Published in *The Bulletin of Entomological Research*, Vol. 16, Part 4. pp. 369-372.) (2) Notes on the Chinch Bug as a Pest of Grass Lawns. (3) *Carsidara Malachrae*, n.sp. Psyllidae.
J. E. PEAT, B.SC.	..Genetic Studies in *Ricinus Communis* L.

1925-1926.

H. G. MILLER, B.SC. (Edin.) ..	..A General Developmental Study of Cotton grown at different spacings.
H. C. E. BULWER, Dip. Agr. (Middleburg) C.P.	..Green Manure Crops.
E. R. GUEST, B.SC. (Lond.)	..On the Inheritance of certain characters in the Cowpea.
F. E. KENCHINGTON, B.SC. Agr. (Lond.)	..Inheritance in Cotton.
J. V. LOCHRIE, B.SC. (Glasgow) N.D.A., N.D.D.	..(1) Inheritance Studies in *Dolichos Lablab*, L. (2) Inheritance Studies in *Ricinus Communis*, L.
J. C. HAIGH, B.S.C. (Lond.) A.R.C.S. ..	..Inheritance Studies in *Stizolobium* Spp.

1926-1927.

H. K. HEWISON AND J. E. SYMOND	..*Cotton*: (*a*) A study of the influence of Environment upon development. (*b*) An investigation of the incidence of *Alternaria* leaf spot. (*c*) A study relative to the occurrence of *Dysdercus*.
P. A. BOWMAKER, B.SC., Agr. AND .. D. W. H. BAKER, B.SC., Agr. ..	An experiment designed to determine the optimum date of sowing for Sea Island Cotton.
J. A. CRAIG, N.D.A. Dip. Agr. (Glasgow.) AND T. D. RUTTER, B.SC., (Lond.) ..	Growth development and yield of maize as affected by time of planting.
R. G. HEATH, B.SC. (Lond.) AND .. J. G. REYNARD, B.SC. Agr. (Aberdeen) ..	Some notes on germination and subsequent early growth of certain sugar-cane varieties.
H. MUSK AND S. J. F. DIAS ..	..Sweet Potato Trials.
C. HARVEY, B.SC. AND C. O. OATES, N.D.A.	..Some observations on Sunn Hemp.
J. L. MOERDYK, B.SC., Agr. AND .. V. F. O. OLIVIER, B.SC. Agr.	Studies in the distribution of certain characters in an Egyptian Upland Cross.
L. H. A. STONE, B.SC., AND .. T. L. WILLIAMS, B.A.	Inheritance in *Stizolobium*.
D. MACDONALD, B.SC. Agr. AND .. C. L. NEWMAN, B.SC. Agr.	Preliminary work on water relations of crops.
K. T. HARTLEY, B.SC. (Oxon). ..	..The Slaking of Dry Soils (Published in *Journal of Agricultural Science*, Vol. 18, Part 1, 1928).
W. V. HARRIS, B.SC.	..(1) A *Lycaenid* Butterfly attacking pineapples in Trinidad, B.W.I. (Published in *The Bulletin of Entomological Research*, Vol. 18, Part 2, pp. 183-189.) (2) *Utetheisa Ornatrix*, L. and other insects attacking Sunn Hemp in Trinidad, B.W.I.
W. P. K. FINDLAY, B.SC., A.R.C.S., D.I.C.	..A Preliminary Investigation into some of the factors affecting the development of Bacterial Diseases in Cotton due to *Pseudomonas Malvacearum* (E.F.S.)
H. B. SPRINGER AND J. G. DAVIES ..	..Phosphates in Cane Juice.

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The following list has been compiled from information supplied by various Agricultural Departments at the request of the Colonial Office. Unfortunately the list is not quite complete owing to the fact that information has not yet been received from several Departments.

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SYNTHETIC ORGANIC MANURE.

Methods of Manufacture.

By F. HARDY, M.A., Dip. Agr.
Professor of Chemistry.

THE general subject of cellulose decomposition, which forms the basis of the production of manure from waste vegetable matter, has been fully discussed by the writer in this Journal in the following previous articles.

(1) Mauritian Pen Manure, *Trop. Agr.*, 1924, Vol. I, p. 116.
(2) Artificial Farmyard Manure, *Trop. Agr.*, 1924, Vol. I, p. 133.
(3) Synthetic Farmyard Manure, *Trop. Agr.*, 1925, Vol. II, p. 108.
(4) Sugar-cane Trash as Manure, *Trop. Agr.*, 1925, Vol. II, p. 121.
(5) Rate of Cellulose Decomposition, *Trop. Agr.*, 1926, Vol. III, p. 248.
(6) Use of Distillery Sludge (by V. M. Hinchy), *Trop. Agr.*, 1927, Vol. IV, p. 129.
(7) Biochemical Decomposition of Cellulosic Materials, *Trop. Agr.*, 1927, Vol. IV, p. 143.
(8) Organic Manures from Sugar-cane, *Trop. Agr.*, Sugar Supplement 1927, Vol. IV, p. 47.
(9) The Composition of "Adco" Manure made in Trinidad, *Trop. Agr.*, 1928, Vol. V, p. 144.

In these articles, it has been indicated that the chief conditions requisite for satisfactory breakdown of waste vegetable matter are :—

(*a*) Suitable composition of the waste material employed. (The ratio of pentosan content to lignin content must be greater than unity for rapid decomposition to ensue).
(*b*) Suitable supply of some assimilable nitrogen compound.
(*c*) Suitable supply of mineral salts, such as phosphate, magnesium salt, chloride, &c.
(*d*) Suitable supply of water.
(*e*) Suitable supply of air.
(*f*) A neutral or alkaline reaction.
(*g*) Proper admixture of the re-acting substances.

(*a*) *Composition of raw material.*

The best results have so far been obtained with rice straw, wheat straw and other cereal straws ; garden refuse, including grass, sugar-cane trash, and other leafy materials.

Unsatisfactory results, on the other hand, have been obtained with wood sawdust, coconut-husk, rice husk, banana stems, bracken and sugar-cane megass, which apparently contain too much lignin.

(*b*) *Nature of nitrogenous compound.*

(i) In the ordinary *cattle stall* or *pen method* of making manure, the necessary additional nitrogen over and above that contained in the raw material (bedding), is furnished by the urea contained in animal urine.

(ii) In the *Mauritian method*, the same source of nitrogen is utilized, but it is made to go further.

(iii) In the *ammonium salt method*, originally investigated at Rothamsted, some ammonium salt, such as ammonium sulphate or carbonate, supplies the necessary nitrogen.

(iv) In the "*Adco*" *method*, the nitrogen is supplied by some compound present in the patented "Adco" mixture. This mixture appears to contain all the ingredients necessary to effect a highly satisfactory breakdown of a great many waste vegetable products.

(v) In the *distillery sludge method*, the nitrogenous compounds (mainly protein), present in the dead yeast cells that comprise the solids of the sludge, supply the necessary nitrogen.

It would thus appear that a large and varied number of nitrogenous substances are more or less suitable for addition to waste vegetable matter used in the manufacture of synthetic farmyard manure. Whilst some are not entirely satisfactory, their cheapness and plentifulness under any particular set of economic conditions that may obtain on a farm or estate, render them worthy of continued and serious trial.

In actual practice, failures may be frequent, especially when the simpler and cheaper materials are tried. Nevertheless, farmers and planters in many countries are giving increasing attention to the subject, as the importance of conserving the soil's supply of humus is becoming more and and more clearly recognised.

In this connection, two recent articles describing experience in the United States are worthy of citation.

(1) "Production of Artificial Farmyard Manure by Fermenting Straw," by W. V. Halversen and E. F. Torgerson (Oregon), *Journ. Amer. Soc. Agronomy*, July, 1927, Vol. XIX, No. 7, p. 577.

In this investigation, experiments were first made to test the relative value of various nitrogenous substances in the breakdown of wheat straws. There were tried : ammonium phosphate, sodium nitrate, diluted urine, and ammonium sulphate, used together with enough powdered limestone to maintain neutral reaction conditions. Of these substances, the last-named gave the best results under laboratory conditions. It was therefore tried on a semi-large scale in tank experiments, various proportions of straw to nitrogen being examined in order to discover the most effective and economical mixture. The following is a practical recommendation emanating from these trials. One ton of dry straw, treated with 47.6 lb. of ammonium sulphate (cost, $2.06), 100 lb. of ground limestone (cost, $0.32), and five tons of water, gave three tons of finished manure, costing therefore (in Oregon) about $0.80 per ton, exclusive of labour charges. The treatment is equivalent to 0.5 per cent. of nitrogen on weight of dry straw basis.

(2) "Farm Trials of Artificial Manure," by W. A. Albrecht, and E. M. Poirot, (Missouri), *Jour. Amer. Soc. Agronomy*., Feb., 1928, Vol. XX, No. 2, p. 123.

This investigation had the following projects: (*a*) to discover the most suitable nitrogenous reagent; (*b*) to mix this with straw by applying it *through the thresher*, and (*c*) to test the possibility of depending solely on *rainfall* for supplying the meeded moisture. Ammonium sulphate was favoured as nitrogenous re-agent. A mixture containing 45 per cent. of ammonium sulphate, 40 per cent. of ground limestone, and 15 per cent. of calcium superphosphate, applied at the rate of 150 lb. per ton of straw, gave the best results. The mixture may advantageously be applied through the thresher. If the treated straw be spread in shallow flat piles, sufficient moisture may be gathered from the natural rainfall (in Missouri) to give a satisfactory fermentation.

In Germany, similar investigations are being actively prosecuted. Besides ammonium sulphate, ammonium phosphate ("Ammophos") and commercial urea, are being tried as nitrogenous re-agent. The last-named offers possibilities. It is nowadays manufactured on a large scale from calcium cyanamide, and is comparatively cheap. Urea is the chief nitrogenous compound of animal urine.

(*c*) *Mineral salts requirements.*

Of the salts required, phosphate seems to be the chief salt needed by the cellulose-decomposing organisms for proper growth. Generally the raw materials used in making artificial farmyard manure, contain insufficient amounts of phosphate. It is therefore often added, usually in the form of ground mineral phosphate or superphosphate. Occasionally, magnesium sulphate (Epsom salts), and common salt are also added.

(*d*) *Water requirements.*

Watering the stack requires especial care in the manufacture of synthetic farmyard manure. In the humid tropics, rainfall could doubtless be more profitably utilized than it is. A stack of dried grass, herbage, sugar-cane trash, &c. made shallow, and containing a suitable nitrogenous re-agent, together with lime and phosphate, if needed, might be made up during dry weather, and left until the rains arrive to wet the heap. Penetration may not proceed satisfactorily, however, unless special attention be given to the shape, depth, texture and composition of the heap. Various procedures should be tried. If the heap be accumulated and treated dry with the requisite powdery mixture in proper amount during the period when the waste-vegetable material is available on the farm or estate, the cost of handling might be reduced very considerably. Perhaps the heap may have to be turned at least once during subsequent wet weather, in order to attain uniform and thorough decomposition.

(*e*) *Air requirements.*

Here again, experience with the particular raw material which it is desired to convert into manure, and with the particular nitrogenous agent which is to be added, alone will enable the experimenter to decide what degree of compactness (texture) of the heap is required in order to obtain the most suitable aeration.

(*f*) *Reaction requirements.*

Many synthetic manure heaps appear to owe unsatisfactory breakdown to the fact that conditions have been allowed to become acidic. Examination by the electrode method of liquid runnings or water-extracts obtained from them, readily demonstrated this condition. In every instance where a nitrogenous agent, other than a definitely alkaline substance, such as ammonium carbonate, is employed, adequate amounts of ground limestone should be incorporated into the heap.

(*g*) *Admixture of the reacting substances.*

The need for proper mixing when compiling a heap, need not be stressed. The use of chopping machinery for comminuting bulky vegetable matter, such as rank grass or woody herbage, deserves critical trial. If the employment of a chopping machine be found advantageous, the powdery nitrogenous agent could be fed directly into it. This would ensure very thorough admixture.

It is obvious that there is much scope for further experimentation in the profitable utilization of different sorts of waste vegetable matter, both in temperate and in tropical countries. Whilst the fundamental principles appear to be relatively simple, many practical difficulties may arise when attempts are made to apply them under a particular set of conditions. Much perseverance may be needed to attain complete success.

AGRICULTURAL RESEARCH.

Imperial Conference's Report.

THE Report of the Imperial Agricultural Research Conference, just issued, contains a full account of the events leading up to the Conference, the recommendations (both in full and in summary form) there made and the views expressed by the highest authorities in agriculture in all quarters of the Empire. The recommendations deal with the following subjects:—The establishment of an Imperial chain of Agricultural Research Stations. The establishment of Imperial clearing houses of information. The recruitment, training and interchange of scientific workers in agriculture for the whole Empire. The action immediately necessary to secure co-operative work in such specialist subjects as Veterinary Science, Animal Nutrition and Genetics, Dairying, Soils and Fertilisers, Plant Breeding and Pathology, Fruit Growing, Entomology, Preservation and Transport, and Agricultural Economics.

The Report of 250 pages is issued at the specially low price of 1s. post free, in order that it may be within easy reach of all those affected. Readers in the West Indies and British Guiana can obtain copies 1s. post free, from Professor C. Y. Shephard, Imperial College of Tropical Agriculture, Trinidad.

FIELD YIELDS AND LOSSES.

BY W. SCOTT, B.SC.
Professor of Sugar Technology.

[*The article below was given in the form of an address to an audience of sugar planters on Sugar Field Day at the Imperial College of Tropical Agriculture on 16th May, 1928.*—ED.]

IN the past, yields of sugar were referred to principally in connexion with factory work; and efforts were concentrated on increasing the factory yield of sugar. To-day, in progressive sugar-producing countries, the most important figure is the yield of sugar per acre; and not merely the yield per ton of cane.

In order to obtain the maximum yield of sugar per acre, thorough co-operation is necessary between the fields and the factory. In other words, the maximum production of sucrose in the fields, must be accompanied by maximum extraction in the factory. But, without a proper understanding of each other's requirements, losses will be sustained by both the fields and the factory which could be avoided.

In a modern sugar factory, efficiently equipped and managed, the question of yields becomes a matter of routine, variations in extraction and recoveries not exceeding fractions of one per cent.

We shall, therefore, in this instance concentrate on the field aspects of increased yields of sugar; referring to the factory only where it is absolutely necessary to do so.

Factors affecting yield of sucrose per acre:—Variety of Cane; Length of Growing Period; State of Maturity; Suckering; Plant Cane or Ratoons; Manuring; Irrigation; Drainage; Climatic Conditions.

Variety of cane:—The yield of Sucrose per acre depends upon two main factors:—

(*a*) Tons of Cane per acre.

(*b*) Quantity of Sucrose per Ton of Cane.

It often happens that a variety giving a high yield of cane per acre, has a low sucrose content and *vice versa*. The ideal cane would be, of course, one giving a high yield of cane of high sucrose content. If field costs were all calculated in terms of Tons of Sugar, instead of per Ton of Cane, it is obvious that costs of cutting, transport, &c. would be lower in the case of cane containing 14 per cent. sucrose, than in that of cane containing only 10 per cent. sucrose.

Numerous tests made at one of the Trinidad factories (Ste. Madeleine) have shown that the yields of Sugar per Ton of Uba amounts to about 80 per cent. of the yield from B.H.10(12). This means that 25 per cent. more Uba than B.H.10(12) must be grown, cut, transported to the factory, and milled in order to produce the same quantity of sugar. Uba has, however, certain characteristics which make it a desirable cane in special cases.

A new variety has recently been developed in Java: (P.O.J. 2878) which is expected to yield at least 25 per cent. more sucrose per acre, than the other varieties at present cultivated there. Incidentally, the development of new Cane Varieties is considered of such importance in Java, that an Association has been formed for the "granting of premiums for the raising of Sugar-Cane Varieties."

Length of growing period and State of Maturity:—The length of growing period, as well as the state of maturity of the cane have an important bearing on the yield of sugar per acre.

When one hears of high yields of sugar per acre in certain parts of the world, it is well to investigate the time required to produce these yields, as well as other conditions under which those yields are obtained. In Hawaii, for instance, the average yield for a number of years for all the Islands was about 45 short tons of cane per acre with a raw sugar yield of 5.5 short tons per acre. The average growth of all cane, including ratoons, extends there over a period of 18-24 months. Java on the other hand produces about the same quantity of cane and sugar per acre, but with a period of growth extending over 11-15 months. Here, however, only plant canes are grown. Both countries use irrigation extensively, Java 90 per cent. and Hawaii 50 per cent.; hence the maturity of the cane can be better controlled than where natural climatic conditions have to be relied upon.

The influence of irrigation as a means of controlling the maturity and hence the richness of the cane is well illustrated by figures obtained within the Hawaiian Islands themselves. On the Island of Maui, where irrigation is extensively used the average sucrose in cane over a period of ten years was 14.65 per cent.; while on the Island of Hawaii, where cane is grown under natural conditions the average sucrose in cane during the same period was only 12.48 per cent.

Suckering.—Those facts bring us to the consideration of the next factor influencing the yield of sucrose per acre. The great variations in the percentage of sucrose in cane from one year to the next, and even from one period of crop to another, are loosely ascribed to climatic conditions. Although this is fundamentally true, the immediate cause of those variations in the average sucrose contents of the cane is due to the presence of a greater or lesser percentage of immature canes or "suckers." Anyone who has dealt with large numbers of cane samples knows the wide variations which might be expected between "picked" cane samples (*i.e.* full grown canes) in the field and bulk samples from the same field. Differences

between plant canes and ratoons of the same variety; and differences between various varieties when considered in bulk are often accounted for by the different percentages of immature canes or "suckers." In other words, fully matured canes in the various classes may show only slight differences in sucrose contents or purity of juice; while the bulk samples may show very wide variations.

We all know that ratoon cane, especially during the earlier part of crop, is generally richer in sucrose than plant cane of the same variety. This is because, owing to a well established root system at the beginning of the growing period, there is a large percentage of original stalks to the total yield per stool in ratoon cane. Also, owing to the thinner stand, the younger cane in a ratoon field approaching maturity is more easily subjected to the ripening influence of air and sunshine, than is the case with plant cane.

Experiments made in Louisiana by the Sugar Experiment Station have conclusively brought out the relation between a heavy early stand of cane, a low ratio of increase and the greatest amount of sugar per ton of cane. Their recommendations are as follows:—

(1) Obtain a large number of stalks as early as the weather will permit;

(2) Encourage a few early suckers, then cultivate to suppress further suckering.

This advice is intended for Louisiana conditions, but it is probable that by the judicious use of fertilizers and suitable cultivation, suckers can be controlled to a certain extent even under tropical conditions, and when irrigation is not available.

Manuring.—The effect of manuring on the ultimate yield of sugar has given rise to many contradictory statements. The time of application of the fertilizer and the period of growth to follow the application are certainly important factors. Fertilizers may be applied as stimulants in order to obtain the maximum growth at a given period. Excessive quantities of fertilizers followed by a short growing season, will probably result in a fine crop of suckers.

It is evident that the manuring practice cannot be the same with cane which is allowed to grow over a period of two years, as with cane which will not be older than 12 to 15 months when cut. It is much easier in the former case to obtain a heavy yield of cane accompanied by a high sucrose content, even when applying different fertilizers at various times as is the practice in Hawaii.

It is obvious that manuring should be regulated to give the highest yields of *sucrose* per acre; and to achieve this end experimentation is necessary to strike a happy medium between the increase in the yield of cane and the quality of the cane at time of cutting. Deerr thinks that with judicious manuring only the bulk of the cane is affected and not the quality; although the belief is held in many parts that lime and phosphoric acid have a beneficial effect on the quality of the juice; while potash and nitrogen have the opposite effect.

Irrigation and Drainage.—Irrigation, as we have already pointed out, gives the best means of controlling the growth and therefore the period of maturity of the cane. At the present time, the question of irrigation is a remote one so far as we are concerned.

Drainage, however, is a most important question in Trinidad. In a badly drained field the cane will neither grow well nor mature properly. Hence both the quantity and the quality of cane will be affected; and the yield of sucrose per acre will suffer greatly from lack of proper attention to drainage. We need not go further into this question except to point out that drains should be in good condition at the approach of the crop season to allow any surplus water to be quickly removed.

Climatic conditions are not, of course, within our control, although they have a great influence on the yield of sugar. Modifications should be introduced in the treatment of the growing crop to correct as much as possible any bad effects due to adverse weather conditions.

Field Losses of Sucrose.—If we adopt the point of view that sugar is made in the field and merely extracted in the factory, and that the cane stalk is just as much a container of sugar in the raw state as the bag is of the finished article, we immediately realize our responsibility in delivering this quantity of sugar intact to the factory for extraction purposes.

Yet staggering losses occur in the fields, which often remain undetected. It is therefore desirable to point out some of those possible losses which in magnitude are far greater than any losses which might occur during the course of manufacture in the factory.

Losses in Cane after cutting.—Within a short time after cutting the cane begins to lose weight through evaporation, and some cells nearest the periphery of the cane die off. Deterioration (or inversion of sucrose) sets in very quickly in a dead cell. This is why burnt cane deteriorates quicker than unburnt cane, owing to the fact that the stalk has been overheated, and a number of cells killed. Many figures can be quoted to show the great losses in canes left exposed in the fields for several days under tropical conditions.

In two series of experiments carried out at Ste. Madeleine, the following figures were obtained from unburnt cane left lying on trash after being cut.

SERIES I. Ba6032			SERIES II. B.347		
Hours Cut.	Loss in Weight. %	Loss of Avail. Sugar. %	Hours Cut.	Loss in Weight. %	Loss of Avail. Sugar. %
Fresh	0	0	Fresh	0	0
24 Hours	1.60	0.83	24 Hours	3.25	5.77
48 do.	3.01	3.24	48 do.	3.00	7.55
72 do.	6.89	6.93	72 do.	6.00	14.16
96 do.	8.66	12.27	96 do.	6.00	16.87
144 do.	8.63	15.29	144 do.	8.50	26.62

Those figures speak for themselves, and the magnitude of the losses is confirmed by experiments in various other tropical countries.

Dead or Dying Canes.—The yield of sugar would be improved if dead or dying cane could be eliminated from the cane sent to the factory. It must be admitted that it is difficult to tell the condition of the cane from its appearance. Canes with a few yellowing leaves at the top, or which may have lost their leaves completely should be looked upon with suspicion.

During the very dry crop of 1926, a serious problem was faced when whole fields of cane became unfit to grind.

The following are typical analyses of such canes obtained during that crop :—

B. 156—PLANTS—18 MONTHS.

Condition.	JUICE.					
	Cane % Suc.	Brix.	Suc.	Purity (App.).	Glucose.	Glucose ratio.
Tops drying ..	8.59	20.40	9.85	48.28	9.14	92.79
Tops very dry ..	1.93	17.80	2.05	11.52	13.19	643.41
Tops dead	1.34	18.30	1.68	9.18	15.05	895.83

It is obvious that, not only can no sugar be obtained from cane of that description, but also that the admixture of such juice would have a detrimental effect on the available sucrose from the sound canes.

Tops.—Green tops, including the so-called "white" joints, are responsible for a certain loss of available sugar. This fact has been proved in various series of experiments made at both Ste. Madeleine and the College Laboratories.

The average of a series of tests which have already been published, gave the following analyses :—

	JUICE.				
	% Sucrose.	Brix.	Suc.	Purity.	Tops per cent. Cane.
Tops only	4.17	12.23	5.43	44.39	11.84
Cane without Tops..	12.71	18.20	15.38	84.50	—
Cane with Tops	11.65	17.50	14.39	82.22	—

We have calculated that it would take 8.72 tons of the cane without tops to give one ton of sugar, while 10.34 tons of the same canes with tops, or 18.42 per cent. more, would be required to produce a ton of sugar. Since the tops only increased the weight of the cane by 11.84 per cent., it is evident that there was a net loss, or in other words that a certain amount of originally available sucrose had been made non-available.

Trash.—The presence of trash in the cane causes a loss in extraction owing to the fact that the trash absorbs juice which it carries away to the furnaces. The drier the trash, the more juice it will absorb.

Losses caused by the Giant Moth Borer ("Castnia Licus").—A number of tests were made during the 1926 Crop at Ste. Madeleine in an attempt to obtain an approximate idea of the effect of Borer attacks on the sugar yield. Those tests were carried out by Messrs. Springer and Davies, Sugar Technology Students, under the supervision of Mr. G. A. Jones and myself.

Counts were first made to determine the varieties most susceptible to Borer attacks. A count of 50 stools from each of the principal varieties from 2nd Ratoons experimental plots gave the following percentages of attacked canes on the total :—

B.156	36 per cent.
B.H.10(12)	24 per cent.
B.347	10.9 per cent.
Ba6032	6.9 per cent.
Uba	1.0 per cent.

Those figures are, of course, merely the result of one count, and are not to be taken too literally.

Four experiments were undertaken with the object of ascertaining the loss in sugar per acre through canes damaged by the Borer. Canes analysed included B.H.10(12), 1st and 2nd Ratoons, and B.156 1st and 2nd Ratoons.

The average results of all the experiments were as follows :—

CANES ATTACKED PER CENT. TOTAL = 32.2 PER CENT.

LOSS IN WEIGHT OF ATTACKED CANES = 14.61 PER CENT.

	Juice.					
	Cane % Suc.	Brix.	Suc.	Glucose.	Purity.	Glucose ratio.
Sound Canes	15.59	22.35	19.78	1.36	88.50	6.87
Attacked Canes	13.86	21.55	17.87	2.50	82.64	14.00

Calculated Yield 96° Sugar per cent. Cane { Sound Canes = 14.09; Attacked Canes = 11.91

If we assume a normal yield of 20 tons of sound canes per acre, the corresponding yield of sugar per acre is 2.82 tons. Allowing for 32.2 per cent. of damaged canes, the yield of cane per acre drops to 19.05 tons, and the yield of sugar to 2.56 tons, a reduction of 9.25 per cent. If, on the other hand, we merely consider the cane delivered at the mills we find that the difference in yield between sound and attacked canes amounts to 15.5 per cent.

The above figures do not, of course, include canes which were destroyed in the earlier stages of growth either by the Borer, or by disease following the Borer attack.

It is therefore evident that effective control of the Giant Moth Borer would tend to increase the yield of sugar per acre.

Froghopper Blight—It is hardly necessary for me to refer here to this particular source of losses to Trinidad planters except to point out that the benefits to be derived by the industry from the thorough scientific investigations now under way, will probably extend well beyond the limits of the mere control of the pest ; and that the improved methods suggested as control measures will also result in producing higher yields of sugar per acre.

SUMMARY.

It is of the utmost importance to the economic production of sugar that yields of sugar per acre be increased.

This can be achieved :

1.—By increasing the yields of cane ;
2.—By increasing the sucrose contents of the cane ;
3.—By reducing losses of sucrose in the fields.

REFERENCES :

F. Maxwell—Economic Aspects of Cane Sugar Production.
N. Deerr—Cane Sugar.
H. J. Rodrigues—Relation between high Sucrose and Suckering.—*Louisiana Planter.*
W. Scott—Deterioration in Cane after Cutting.
W. Scott—U.S.M. Crop Reports.

CORRESPONDENCE.

The Editor, *Tropical Agriculture.*

DEAR SIR,

In the May issue of *Tropical Agriculture,* pages 120-1, a review is published of the Agricultural Industry in the Union of South Africa from 1910-1925. The reviewer appears to suggest that the Technical Divisions are of little value. Although contact with the farmers is not as close as might be desired, officers do keep abreast of conditions, one or more invariably being on investigational tours. Close contact is kept with farmers and Headquarters by the members of the Extension Division, who comprise the staffs of the Schools of Agriculture, and Extension and Domestic Science Officers.

Although the fact that the Extension Officers are mostly "young fellows who have only recently left College" may diminish their influence, they are, nevertheless, doing yeoman service to the farmers. Extension officers have no opportunities or time for "eye-wash." The fact that in 1925 seven Extension Officers were responsible for 470,000 square miles, admittedly indicates the need for expansion in numbers.

The reviewer seems to be labouring under a misapprehension regarding the use of American Aloe and Prickly Pear. It is not claimed that they provide nutrients but that they add succulence to the feed. The writer knows from personal experience that but for them many very valuable Frieslands and other animals would have died during the last big drought, through lack of succulence in their feed. Prickly Pear is very palatable after the thorns have been removed. Stock get to like American Aloe though doubtless if fed *alone* to milk cows it would lead to their early death.

As American Aloe is only grown for, and Prickly Pear utilised during periods of stress, they do not increase the carrying capacity of the land in normal periods and cannot therefore increase distress during droughts.

I am,

Yours faithfully,

H. P. SMART.

* * *

To the Editor.

Your correspondent criticised my review of the South African Official Year Book mainly on two grounds, firstly that I have not done justice to the Technical Divisions, especially to the "young fellows" of the Extension Division, and secondly that I am incorrect in my remarks about the use of Prickly Pear and American Aloe, as food for cattle. With regard to this latter question, in view of your correspondent's personal experience, I can only ask your permission to modify my remarks. I was writing from personal experience also, and my experience has been that very little value can be attached to the use of these fodders, but I am apparently wrong, and it is clear that in certain conditions these plants do help to solve the problem of keeping stock alive in a drought.

With regard to the first point raised, I regret I did not make myself clear. I did not mean to criticise the young men, some of whom I have met, who are entering the Department, keen and ready for work, but the Senior Officers in the Divisions who allot them their duties. The general organisation of the Department is also largely to blame. I have always held the view that an extension division by itself is rather in the air, and that it should be linked very closely to the extent of interchangeability of staff with the experimental and investigational work of a Department. This your correspondent states is now the case in South Africa, but it is a comparatively recent change, of which I was unaware, and which is not covered by the period of the publication under review. The Extension Officers will now be able to speak to the farmers from knowledge, and will not, as heretofore has largely been the case, have to depend on vague generalities, gathered largely from American textbooks.

R. CECIL WOOD.

REVIEWS.

FARM AND ESTATE BOOK-KEEPING, H. Taylor and J. O. Peet. Simpkin Marshall & Co., pp. 376. Price 7*s.* 6*d.*

PRINCIPLES AND PRACTICES OF FARM BOOK-KEEPING, L. F. Foster. Gee & Co., Ltd., pp. viii+476.

The principles of book-keeping are simple, but students seem to get into difficulties over the practice. A textbook, therefore, should explain the principles in a simple and exact way, provide worked examples and numerous exercises. Both the above books do this. The first book is a useful guide to students beginning the study of book-keeping with reference to agriculture. The principles are quickly explained and their special points like treatment of bad debts, consignments are concisely dealt with. Chapter 2, on practice is well provided with examples and the four plans for farm accounts should prove of immediate application for the cases which are contemplated. The chapter on farm costing—revised by Mr. J. S. Simpson—is quite a good introduction to the subject. References are given to several other things, banking, negotiable instruments, income tax, company accounts and commercial terms—which should widen the reader's knowledge of business methods. The book is intended as an elementary textbook for students and fills that purpose admirably. It is of course written from the point of view of British agricultural conditions but readers in the tropics should find it very helpful.

Mr. Foster's book deals almost entirely with financial accounts and being larger and more specialised it goes into more detail than that of Messrs. Taylor and Peet. It is written very clearly and the illustration of the different steps of book-keeping by references to single set of farm accounts renders the exposition all the better. The book should prove valuable in extending

and rendering more definite the ideas of readers and students who already have a general idea of farm accounting. It is to be hoped that the writer will at some future date provide a key for private students. A readable appendix is given on costing. At one point the writer states "Until the farming classes adopt a good system of financial accounts . . . the importance of cost accounts in farming remains to be realised." The reviewer is of the opinion that although it would be interesting to get at agricultural costs per unit it is difficult to be accurate except with prime costs and that the securing and analysing of these is useful for management purposes even if indifferent finance accounts are kept.

In a review of a work by Mr. Kersey in *Tropical Agriculture* Vol. IV, page 197, the readers may have gathered the reviewer does not favour the tabular system. Since then he has seen a similar system used in the smaller West Indian Islands, and thinks that it would be useful on the smaller proprietor managed estates producing a variety of crops, and recommends Mr. Kersey's pamphlet to the consideration of such planters.

G. W.

* * *

AN ECONOMIST'S PROTEST, Edwin Cannan. P. S. King & Son, Ltd., pp. xx+438. Price 16*s*.

In this book there is collected a selection from the letters and articles, published and un-published, written by Professor Cannan from 1914 to 1926. During the war he protested vigorously, but unfortunately with little effect, against the many extraordinary delusions which gained currency from the belief that "in time of war economic laws don't work." He protested against the first war slogan "Business as usual," against the belief that all prices should remain as before the war, and against the general failure to appreciate the function of prices. He insisted upon the issue of paper money as the cause, and not the effect, of rising prices. Throughout, his articles are marked by that characteristic bluff almost iconoclastic criticism which will delight his former pupils. Others, to whom Professor Cannan is merely a name, can find in this book a remarkably fine portrait of a leader in modern economic thought.

C. Y. S.

* * *

EDIBLE OILS AND FATS. By G. D. Elsdon, B.SC., F.I.C., Earnest Benn, Ltd., London.

This book deals exhaustively with the properties, composition and standard tests of the edible oils and fats, their components, substitutes and adulterants. Due weight has been given by the author to the older methods of examination, but he has also included those newer methods which show promise of usefulness. Over two thousand references are given, which enable readers desiring further information to find the original sources of the abstracts. As a text book and reference book it is worthy of a place on the shelves of all interested in the subject, for no work of such scope has hitherto been published.

P. E. T.

* * *

SUGAR-CANE AND BEET. G. Martineau, C. B. Sir Isaac Pitman & Sons, Ltd., pp. xi + 159. Price 3*s*.

This little book—one of Pitman's Common Commodities and Industries Series—has just been revised by F. C. Eastick, M.A., Refinery Manager of Martineaus, Ltd., and reprinted. The statistics have been brought up-to-date as far as possible, and modifications made in the text to conform with modern practice. The establishment of the Beet Sugar industry in England and the increasing production of white Granulated Sugar direct from the cane or beet juice are prominent features of the revision.

The presentation is in a popular style, the technical detail being introduced in a manner attractive alike to the sugar student and the layman. Dry facts are presented in an absorbing form so that the slogan of the little volume may well be given as "interesting and instructive."

J. O. C.

BOOKS RECEIVED.

WE have to acknowledge the receipt of the following books:—

AGRICULTURE.

The Soils of Cuba. H. H. Bennett & R. V. Allison, pp. 410, Tropical Agricultural Research Foundation, $6.25.

Elements of Live-Stock Judging. William W. Smith, pp. 148, *J. B. Lippincott Co.*, 9*s*.

Silvicultural Systems. R. S. Troup, pp. 200, *Clarendon Press*, 21*s*.

CHEMISTRY.

Biochemical Laboratory Methods. Clarence Austin Morrow, pp. 350, *John Wiley & Sons Inc.*, 18*s*. 6*d*.

ECONOMICS.

Minimum Wage-Fixing Machinery. International Labour Office, pp. 156, *P. S. King & Son Ltd.*, 2*s*. 6*d*.

GENERAL.

Papua of to-day. Sir H. K. Murray, K.C.M.G., pp. 308, *P. S. King & Son Ltd.*, 21*s*.

India in 1926-27. J. Coatman, pp. 378, *Government of India Central Publication Branch*, 3*s*. 6*d*.

Index Biologorum 1. Edited by G. C. Hirsch, pp. 546, *Julius Springer*.

TECHNOLOGY.

Sugar Beet and Beet Sugar. R. N. Dowling, pp. 277, *Ernest Benn* 15*s*.

ZOOLOGY.

Animal Biology. J. B. S. Haldane & J. Huxley, pp. 344, *Clarendon Press*, 6*s*. 6*d*.

Insect and Fungus Pests of the Farm. J. C. F. Fryer and F. T. Brooks, pp. 198, *Ernest Benn* 8*s*. 6*d*.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Thermo-Plastic Substances from Rubber.

A successful attempt has been made to convert raw rubber into materials similar to gutta-percha, balata and shellac. By heating sheets of an intimate mixture of rubber and an organic sulphonic acid, or an organic sulphonyl chloride, for several hours at a temperature of 125-135°C. a plastic, sticky mass is obtained, which, in cooling, sets to a hard, brittle mass with a rubber-like surface film. This product softens in hot water or in contact with hot rollers, when it can be molded, cooling again to a hard balata-like substance. By varying the amount of reagent added, and the time and temperature of heating, substances of different properties can be obtained. Thus, using blocks of mixture instead of sheets, and heating to 141°C when an exothermic reaction takes place within the block, a hard shellac-like material is produced. A mixture containing 70 parts of p-phenyl sulphonic acid per 100 parts of rubber when heated for six hours, produces a gutta-percha like substance, soluble in the usual organic solvents and possessing strong adhesive power. Mixed and heated with concentrated sulphuric acid, raw rubber gives a hard balata-like substance.

These products have been named 'Themoprenes'. They can be vulcanised to give hard non-plastic substances. They are non-conductors of electricity. A wide field should be open for substances possessing such a valuable combination of properties.—(H. L. Fisher, *Ind. Eng. Chem.*, 19, 1325, 1927.)

* * *

Effect of Soil Treatments on Composition of Soya Beans.

Messrs. Schuster and Graham have recently reported the results of their trials with lime and various fertilizers on the composition of soya beans grown at the Delaware Experiment Station (*Journ. Amer. Soc. Agronomy*, July, 1927, Vol. LXXIX, No. 7, p. 574.)

They found that *lime* significantly reduced the content of fatty oil in the beans. This result is in full accord with a physiological action which lime is likely to exert on the transportation and accumulation of fat in plants. The subject has been fully discussed in this Journal (*Tropical Agriculture*, 1924, Vol. I, p. 189; "Vegetable Fat Production and the Calcium Content of Soil" F. Hardy). Indeed, in that article are given other instances in which liming has brought about a reduction in the fat content of soya beans, so that the positive relationship between the lime status of a soil and the fat content of an oleaginous plant supported by it appears to have been definitely established.

The Delaware Experiments quoted above also prove that the use of fertilizers brings about no appreciable change in the protein content of soya beans, and that each of the substances tried (with the exception of lime), produced only small changes in oil content. One must therefore look to the geneticist for methods of increasing both the protein and the oil content of soya beans grown for food.

* * *

Commercial Casein.

One of the problems of the old fashioned dairy industry was the disposal of skimmed milk. A realization of the valuable properties of its chief constituent, casein, has provided the required outlet. Skimmed milk is mainly a colloidal suspension of casein in water. The casein may be separated or coagulated by allowing the milk to become sour, by adding rennet, or by adding very dilute acid. Once coagulated into lumps, the casein is dried and ground into a powder. The initial removal of fats is essential as they may become a dangerous impurity.

The process is now being performed on a commercial scale. A list of some of the varied uses of casein will give an appreciation of its value. Heated with soda or lime and water it forms a strong waterproof glue. Partially dried, pressed into sheets, and allowed to harden in formaldehyde solution it produces a hard substance used for imitation jade, amber and ivory. Suspended in water with suitable pigments it forms an excellent paint. Many patent foods have a basis of casein, transformed to the sodium salt to render it digestible. It is used also as size for paper, as dressing for leather, and in the manufacture of insecticides, brake linings, and imitation leather.—(*Ind. Chem.*, 1928, p. 20.)

* * *

Synthetic Rubber.

The manufacture of a synthetic material similar in most respects to natural rubber is practically possible. During the war, a special plant in Germany was producing some 2,500 tons of rubber-like material. Its use was limited by the fact that it oxidised in air and could not be vulcanized. Research has provided new accelerators and new refiners which render the synthetic material both stable in air and capable of vulcanization. It is, however, deficient in elasticity, and further research is needed in this direction. Although the product is suitable for many commercial purposes its general use is hindered by the high cost of production, which cannot compete with that of natural rubber. A step nearer the economic production of synthetic rubber is indicated by the announcement that the German Dye Trust is in a position to 'produce easily raw material for synthesis of rubber and gutta percha by contact (or catalytic) synthesis' (*Ind. and Eng. Chem.* 20, 182, 1928). Once isoprene can be produced rapidly and cheaply, synthetic rubber will certainly be placed upon the market. Although this may appear menacing to rubber planters it is probable that, unless very advanced discoveries are made, it will be several generations before the history of indigo is repeated.

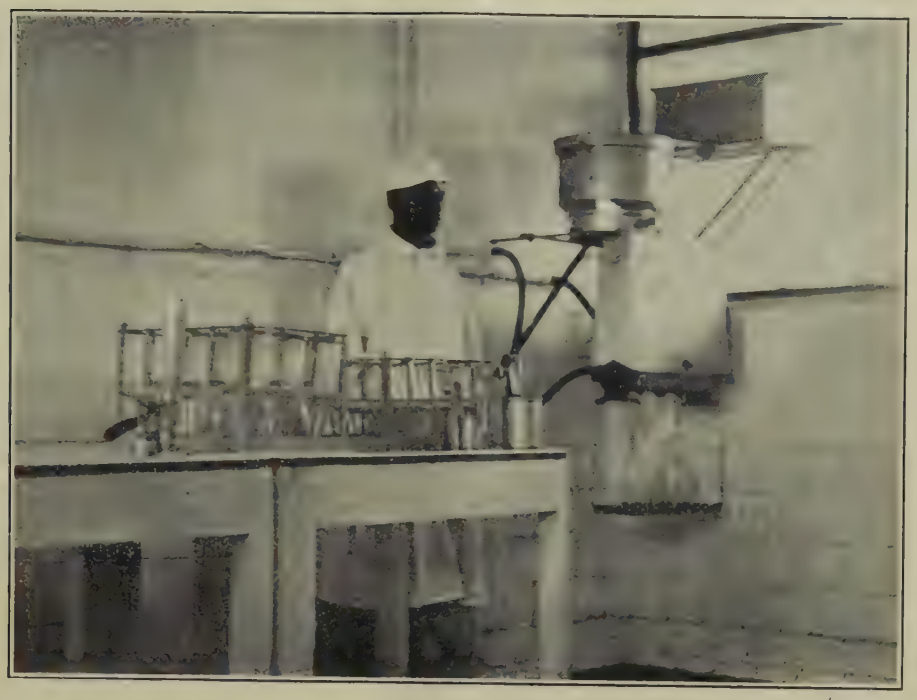

FIG. V.—*Corner of Milk-room showing Receiving tank, Strainer, Cooler and Bottling Apparatus.*

FIG. VI.—*The Dairy Buildings. The Milk house and Calf pens with flat roof for drying corn are on the left. The Cowshed and part of the Silo appear on the right.* [*See page* 159]

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Catalogues on Application.

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Effect of Heating on Specific Conductance of Sugar Solutions.

A Paper on this subject was presented by L. Sattler and F. W. Zerban, before Sugar Division, Amer. Chem. Society, St. Louis, April, 17-18.

The ratio between the chemically determined ash and the specific conductance of cane sugar products is principally influenced by the proportion between inorganic and organic anions, and also by the quantity and nature of the non-electrolytes present. In the electrical method of ash determination in raw sugars devised by the authors the second factor is kept practically constant, while the effect of the first is eliminated by a conductometric titration with hydrochloric acid. In the process of sugar manufacture the non-sugars originally present in the juice and not removed by clarification accumulate in the molasses, and an additional quantity of non-sugars is formed during the manufacturing operations, mainly through the effect of high temperatures.

For this reason a study of this effect was made, using solutions of sucrose, dextrose, and invert sugar to which various inorganic and organic salts such as occur in sugar products had been added. The density of the sugar solutions was in most cases 40 Brix, the salt concentration was N/3, and the initial reaction neutral or slightly acid. It was found that the principal factors causing a change in conductance upon heating are, first, inversion, causing a decrease in conductance; second, destruction of reducing sugars, causing an increase; and third, decomposition of organic amino compounds, also raising the conductance. When the initial reaction is alkaline as with di-and tri-sodium phosphate, the decomposition of reducing sugars is particularly marked. The situation is further complicated by the fact that when the conductivity measurements on the solutions containing organic amino compounds were made after diluting the 40 Brix solutions to about 5 Brix and 0.5 Brix, respectively, the change in conductance brought about by the heating ran in the opposite direction from that observed at 40 Brix. But it is important to note that the percentage difference was considerably greater in the concentrated than in the dilute solutions. It would therefore be expected, as has been pointed out by Honig and by Spengler and Toedt, that the ratios between ash and conductance of different sugar products will be found more nearly alike when the conductance measurements are made in dilute solutions than when they are made at high concentrations of total solids. It follows that when the object is to substitute the electrical method of ash determination for the chemical method, measurements should be made on dilute solutions; on the other hand, if the electrical conductance is to be used as a criterion for the quality of the products on the basis of the ratio between chemical ash and electrical conductance, both determined by experiment, then the conductivity measurements should be made at high concentrations of total solids.

The effect of the splitting off of the amino group is of particular importance in the conductometric method developed by the authors, because here the salts of the amino acids and of the amids produce a buffering effect upon the hydrochloric acid added, while the ammonium salts formed increase the initial conductance.—*Facts About Sugar*, XXIII, No. 17, p. 398.

* * *

Notes on Washing Sugars.

The use of dilute molasses instead of water for washing sugars is described by Ignacio Ruiz in a paper presented before the Association of Cuban Sugar Technologists, Havana, Cuba, December, 1927.

Two tanks of 1,000 gallons capacity each were equipped with unperforated steam serpentines to facilitate the diluting of molasses with condensate water (water condensed from the evaporation of juices) to 70° or 75° Brix. A 3-inch pipe line conducted this diluted molasses to the centrifugals, and to this line at each centrifugal was connected a ¾-inch nipple attached to a hose which was equipped with an automatic sprayer of the piston type. The usual 4-inch clean-out or drain pipe was connected to the bottom of each tank.

With this system a very uniform sugar of bright colour and good general appearance was obtained, care being taken always to use molasses from "straight" strikes. For washing sugars from second massecuites first molasses was used. The coefficient of purity of the resulting molasses increased 2°. Also, it was noticed that when purging with the molasses at a temperature of 85° C., the sugar on the interior surface had the same colour and humidity as that which was nearest the metal cloth of the centrifugal. This is not the case when raw sugars are washed with water. In addition, centrifugals are much more efficient. The water tanks, which very often for some cause contain infected water, are suppressed entirely.

The moisture in the sugar dropped 0.2 to 1.0 per cent. and the polarization never fell below 97.5. This could have been made higher had it been wished. The sugars from unburned cane maintained a polarization of more than 97 for nine months.

During the last month of the crop 60 per cent. of the mill feed was burned cane. With such cane juice care was taken not to drop the daily polarization below 97.5, but after three months in the warehouse it dropped to 94.6. (It is to be noted that these latter sugars were not deposited in the same warehouse with those which stored well). When burned cane is ground during a long period, the system of purging should be changed, using condensate water (water condensed from the evaporation of juice) with the same procedure as that cited above for molasses.—*Facts About Sugar*, XXIII, 18, p. 425.

COLLEGE NEWS.

Dr. H. R. Briton-Jones, Professor of Mycology and Bacteriology, sailed for England by s.s. *Camito* on 15th May for four months' leave.

* * *

We regret to state that Captain Metivier was unable, through illness, to complete his article on "Tropical Dairy Cattle" for this issue of *Tropical Agriculture.*

* * *

The College Sugar Factory closed down after a successful season on 26th May. An account of its operations will be published shortly in *Tropical Agriculture.*

* * *

Mr. A. W. Armour, General Manager of the Liverpool branch of Messrs. Booker Bros., the well known British Guiana firm, and Mrs. Armour visited the College on 5th June.

* * *

Through the kind co-operation of Mr. J. H. Taylor, Manager of Orange Grove Estate, the much needed services of two of his most experienced factory hands, a sugar curer and a triple boiler, were secured for the College Factory.

* * *

Mr. P. E. Turner, Lecturer in Chemistry specially seconded for research work in cane soils under the auspices of the Froghopper Investigation Committee at the College, sailed for England by s.s. *Crynssen* on 5th June on four months' leave.

* * *

Dr. C. W. Wardlaw, who was recently appointed Pathologist in connection with the College Banana Research Station, sailed by the s.s. *Canadian Carrier* on 26th May for St. Lucia, where he will carry out investigations in connection with Panama Disease.

* * *

A very successful meeting of the Trinidad Science Club was held on 25th May, when, in the presence of His Excellency the Governor, Sir Horace Byatt, K.C.M.G., Mr. A. P. Southwell delivered a lecture on "Underground Conditions in Trinidad Oil Fields."

* * *

News has been received that the scheme for Biological Research on cocoa, based on a memorandum submitted by Professor Cheesman to the Principal, has been formally approved by the Governing Body and the question of its finance is now receiving attention.

* * *

Dr. Arthur Hill, Director of the Royal Botanic Gardens at Kew who is also a Governor of the Imperial College of Tropical Agriculture, has returned from his tour of Australia, New Zealand, Java and Ceylon, which we understand was undertaken with a view to securing co-ordination in biological research in the Empire.

Dr. E. J. Maskell, Physiological Botanist to the Cotton Growing Corporation Research Station gave a series of four lectures on "Agronomic Statistics" on 23rd, 25th, 26th May, and 1st June which were greatly appreciated by the students and teaching staff of the College.

* * *

Professor H. Clark-Powell, Transvaal University College, Pretoria, who is touring certain West Indian Colonies and America at the request of the Empire Marketing Board, to report upon the possibilities of growing citrus fruits for export and to confer with the appropriate local authorities on the best methods of cultivation and of preparation for the market, visited the College and stayed with the Principal for a few days early in June.

* * *

A very complete set of spices, neatly put up in tins for ease in handling and demonstration and three samples of Commercial and three of Balata rubber have recently been received by the College through the kindness of Messrs. Lewis & Peat, Brokers. Mr. Alfred Wigglesworth has also very kindly presented a dozen specimens of the principal fibres which will be most useful for teaching purposes. From Messrs. Cadbury Bros., Ltd., come samples of Cocoa-Beans, shell, mass, nibs, butter and cocoa, making, along with a diagrammatic chart, a very complete exposition of the manufacture of cocoa. Our thanks are due to the above-mentioned for their kindness in so readily acceding to our requests for help.

* * *

The following visitors have been to the College recently: Major R. S. Furze, D.S.O., Secretary to the Colonial Office Appointments Board; Mr. L. I. Henzell, Manager of the Gunthorpes Central Sugar Factory, Antigua; Mr. B. B. Davis, Manager of the St. Kitts Central Sugar Factory, Mr. R. J. Burrell, one of the Directors of the Ste. Madeleine Sugar Company; Mr. J. R. Bovell, late Director of Agriculture, Barbados, and Mr. E. E. Maclachlan, Veterinary Surgeon to the Ste. Madeleine Sugar Company; Mr. T. A. Twyman, a Director of the Montserrat Co. Also Mr. J. J. Bruna, Editor of the *Handelsblad* of Amsterdam. Mr. B. R. Wood, Conservator of Forests, British Guiana; Mr. J. N. Oliphant, Conservator of Forests, British Honduras; and Mr. R. C. Marshall, Conservator of Forests, Trinidad, also spent the day here and exhibited the greatest interest in some phases of the research work that is being undertaken. Mr. R. B. Teakle, General Manager of the Canadian National Steamship Co., Montreal, and Mrs. Teakle, visited the College on 7th June and were entertained by the Principal. Great interest was shown in the research and training activities of the College and especially in the tropical fruit and cold storage work.

SIR ALGERNON ASPINALL when addressing the Liverpool branch of the Royal Colonial Institute suggested that the Liverpool refineries might be induced to refine British West Indian Sugar and to place it on the market as a speciality article while some firm of manufacturing confectioners might be induced to produce and advertise on a large scale a pure chocolate from the raw cocoa of Trinidad and Grenada, the practicability of which was demonstrated at the Wembley Exhibition.

COCONUT SCALE.

AN official letter of thanks from the Government of Fiji has recently been received by the Principal, for the assistance and facilities that this College was able to afford to Mr. T. H. C. Taylor, an Entomologist of the Fiji Government, who stayed for several months at the College conducting research work on the control of coconut scale (Aspidiotus destructor), by certain coccinellid beetles.

A letter has also been received from Mr. Taylor himself in which he conveys his personal thanks to the various members of the staff of the College who were able to assist him in his researches. He also gives an interesting account of his voyage from Trinidad to Suva. This occupied five and a half weeks and included a short stay on the Panama Canal. At Colon he transhippd from the Elders & Fyffes boat s.s. *Carare* to the French steamer *Ville de Verdun*. This vessel stayed for five days in Papeete, Tahiti. It is satisfactory to learn that Mr. Taylor having left the College with five different species of coccinellids, was successful in eventually landing all of them in Fiji in sufficient numbers for breeding. The result of the introduction of these parasites on the coconut scale in Fiji will be awaited with great interest.

G. E.

EMPIRE FORESTRY CONFERENCE.

IN preparation for the coming conference in Australia and New Zealand a regional forestry conference was held in Trinidad during the middle of May being attended by the Conservators of Forests of British Guiana, British Honduras and Trinidad and Tobago.

The Assistant Private Secretary who is representing the Secretary of State for the Colonies at the Australian and New Zealand Conference was also present in order to be in a position to indicate the views of these colonies at the coming conference as no official delegate will be available from the colonies in the West Indian Zone.

In this preliminary conference the essential need of a close liaison between forestry and agriculture was stressed and the members gave practical expression to this by spending an afternoon at the Imperial College of Tropical Agriculture. Agriculture and forestry are akin in that they both utilise the soil for the production of crops and there is no doubt but that each can help the other in the many problems which must be solved before the common mecca of maximum production per acre can be attained.

SUGAR FIELD DAY.

ON 16th May representatives of the Trinidad Sugar Industry met at the College for the purpose of viewing the work in progress on sugar cane problems. The Principal, in his welcoming address, expressed the hope that it might be mutually advantageous to repeat the meeting at the end of each crop season.

The morning's programme comprised two lectures, the first by Professor W. Scott, on "Field Yields and Losses," and the second by Mr. P. E. Turner on "Some Soil Factors in relation to Frog-hopper Blight in Sugar Cane." The full text of the first paper, while the substance of the second paper together with other work by Mr. P. E. Turner, will be published in *Tropical Agriculture*.

After lunch in the new College Dining Hall, the visitors broke up into parties. Those accompanying Professor Wood inspected the field work and the new seedling canes, discussed the merits of a series of new ploughs and cultivators specially designed for the cane farmer and small holder, and Mr. L. Grant's (Caroni Sugar Estate) new portable field bridge.

Professor Scott showed the visitors over the Sugar Technology Department where the manufacture of pure cane syrup to suit Canadian and Newfoundland markets, was demonstrated, and Dr. Hurst's samples of white syrups were exhibited. The visitors also went over the Experimental Sugar Factory, which is this year in charge of Mr. E. Loumeau, as Assistant Technologist. Mr. C. T. Watts the College Engineer, showed the visitors some new sugar machinery that has recently been installed, the new power station, and also the work on the new chemical block and the new cold storage building which is nearing completion, and which is designed to conduct experiments in low temperature research on bananas and other tropical fruits.

WE have to acknowledge with thanks the receipt of twenty-seven photographs dealing with tropical agriculture received through the courtesy of the Director of Agriculture, Madras, and the welcome gift of six photographs from the Director of Agriculture, British Guiana, showing rice cultivation and experiments in that Colony.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—United Kingdom markets have continued quiet but values have remained steady. Prices during May were Foreign 96° *c.i.f.* per cwt. 12*s.* 10½*d.* (1st), 13*s.* 1½*d.* (7th-14th), 13*s.* (15th-31st); Preferential, *c.i.f.* per cwt. 16*s.* 7½*d.* (1st-3rd), 16*s.* 9*d.* (4th-17th), 16*s.* 7½*d.* (18th-31st) With poor interest shown in Canada for preferential raws, further quantities of B.W.I.'s have found their way to the United Kingdom, about 6-7,000 tons being sold for shipment during May and June. In consequence of the change in the sugar tariff in the United Kingdom (a note on which will be found on p. 161) refiners ceased to work in bond as from 25th April, 1928, and from that date paid duty on raw sugars instead of refined.

* * *

COCOA.—It would appear that the pick of arrivals from all cocoa producing countries has now passed and it remains to be seen how consumers will act for the stocks available between now and the start of new crop arrivals. Indications are that prices cannot go any lower as visible supplies would not warrant this. Under the circumstances, indications are favourable for a firm market during the next three months.—(*By courtesy of the Cocoa Planters' Association Trinidad.*)

The following comparison of cocoa prices from 1924-27 in London is of interest:

London (shillings per cwt.)

	African. West Coast.	*Trinidad.* Good to fine.	*Ceylon.* Good to sup.
	s. *s.*	*s.* *s.*	*s.* *s.*
31st Dec., 1924 ..	35 to 36	85 to 88	110 to 120
31st Dec., 1925 ..	43 to 45	66 to 73	90 to 100
31st Dec., 1926 ..	70 to 71	78 to 80	80 to 87
31st Mar., 1927 ..	75 to 77	90 to 92	90 to 112
30th June, 1927 ..	75 to 78	85 to 87	90 to 108
30th Sept., 1927 ..	63 to 72	83 to 86	90 to 100
31st Dec., 1927 ..	62 to 65	74 to 77	85 to 93

—(*From Empire Production and Export.*)

Correction.—The last paragraph of the marketing note on Cocoa in the June issue should have been: Prices in the United Kingdom are from 4*s.* to 5*s.* per cwt., higher than a month ago, and in the case of New York about 1 cent per lb.

* * *

COTTON.—The market has been governed by climatic conditions in the cotton belt and their prospective effect on the coming crop. Quick changes of weather in the South and the sensitive fluctuations in the price of futures show that the present is no time for dogmatic assertions either regarding the crop or the future course of values. On the whole recent weather has been favourable and prospects for the future are considered about normal. The spot position calls for no comment, trade generally has been dull but the basis remains steady. On Friday, 18th May, at Liverpool, American middling was quoted at 11.71*d.* per lb. (spot), Egyptian and Sea Island were quiet and a fair business was done in African and East Indian.

* * *

COFFEE.—Up to the middle of May approximately 108,000 bags of Costa Rica were dealt with, leaving about 35,000 bags to come. Foreign clean types found a ready market and Fine London cleaned was in good demand; the cheaper grades, however, were quiet. East Indians have continued to sell well, up to 175*s.* per cwt. has been paid for Mysore bold sizes. The quality of Kenya coffee shows a marked falling of, which fact points to the near approach of the end of this crop. Good to fine lots sold at an advance while for many parcels of common 'end of crop' quality, low prices had to be accepted. Uganda at 100s. provided a serviceable robusta type, and proved an Empire product actually underselling cheap Brazilian.

* * *

TEA.—Latest averages in the middle of May were, 19.26*d.* Ceylon; 19.53*d.* Darjeeling; 17.46*d.* Assam; 16.96*d.* India; 12.74*d.* Java; 14.11*d.* Sumatra. The world exports for 1927 were 919,310,000 lb. as against 866,106,000 lb. in 1926. Increased production is reported from India, Ceylon, Java and China, but Japan and Sumatra are stationary.

* * *

RUBBER.—Prices for Plantation Sheet ranged as follows during May, 8⅛*d.* per lb. (1st); 9*d.* (7th); 8⅝*d.* (17th); 9½*d.* (31st). Malayan shipments fell to 20,029 tons in April from 28,382 tons in March and there was a distinct fall in Dutch production. Strong spot demand and American enquiry found the market short and this coupled with good speculative orders caused prices to advance. Reports from Amsterdam indicate that Dutch producers are not inclined to sell at the present level of prices and advices from the Dutch East Indies indicate that a considerable falling off in native production can be expected in the near future as it is considered that the present price is unremunerative to a large number of native holders.

* * *

COPRA.—Prices in May ranged between £27 10*s.* 0*d.* and £27 12*s.* 6*d.* *c.i.f.* per ton. In mid-May Marseilles was a free buyer of low grade copra at £26 17*s.* 6*d.* per ton, but London took little below £27 7*s.* 6*d.*